

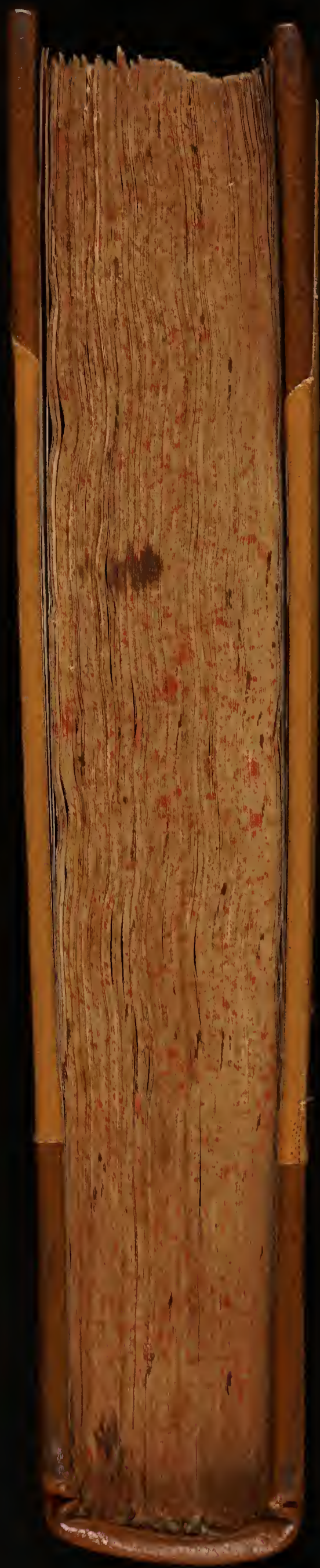


ERCKER  
—  
LAWS  
OF ART  
AND NATURE

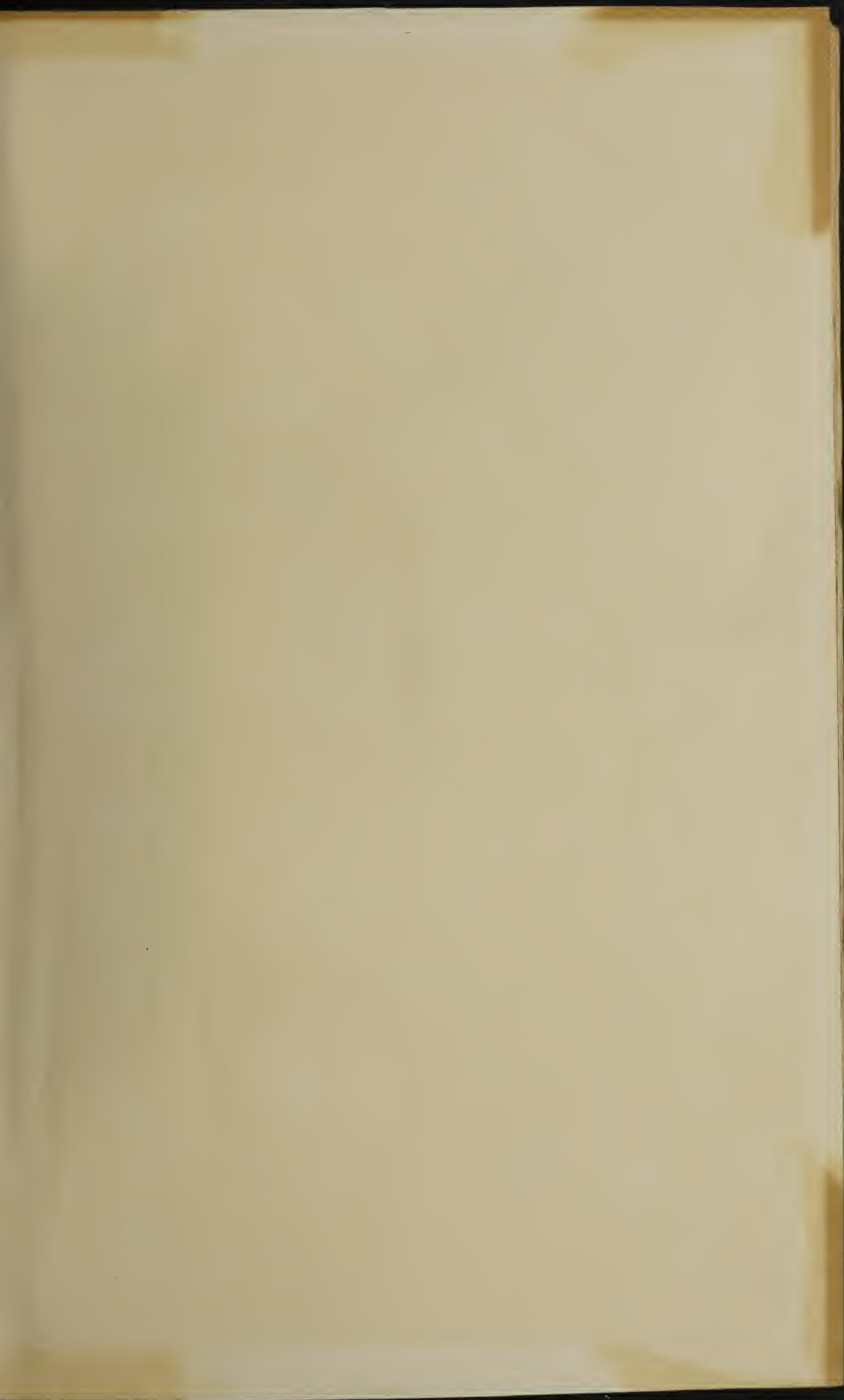
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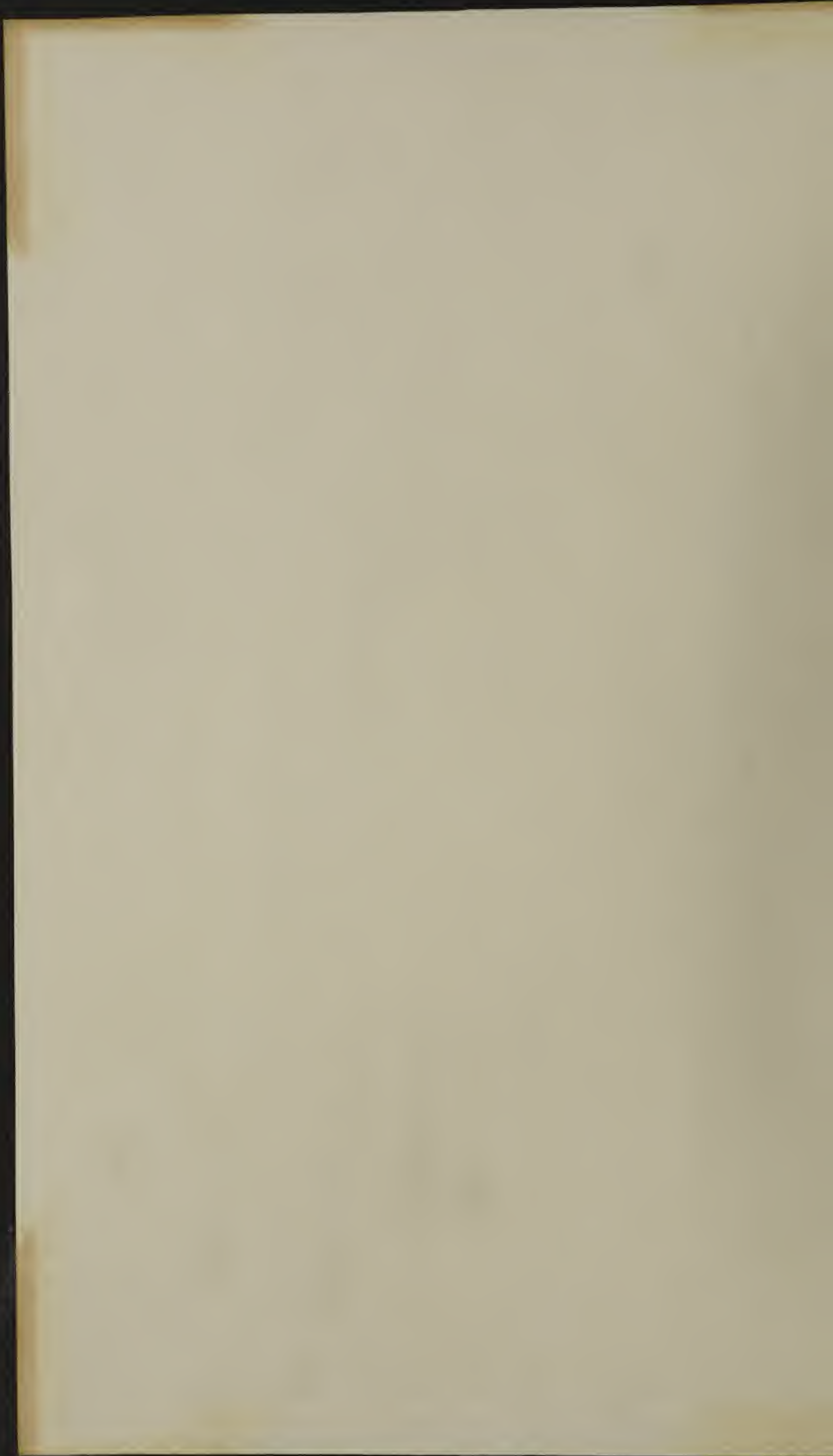






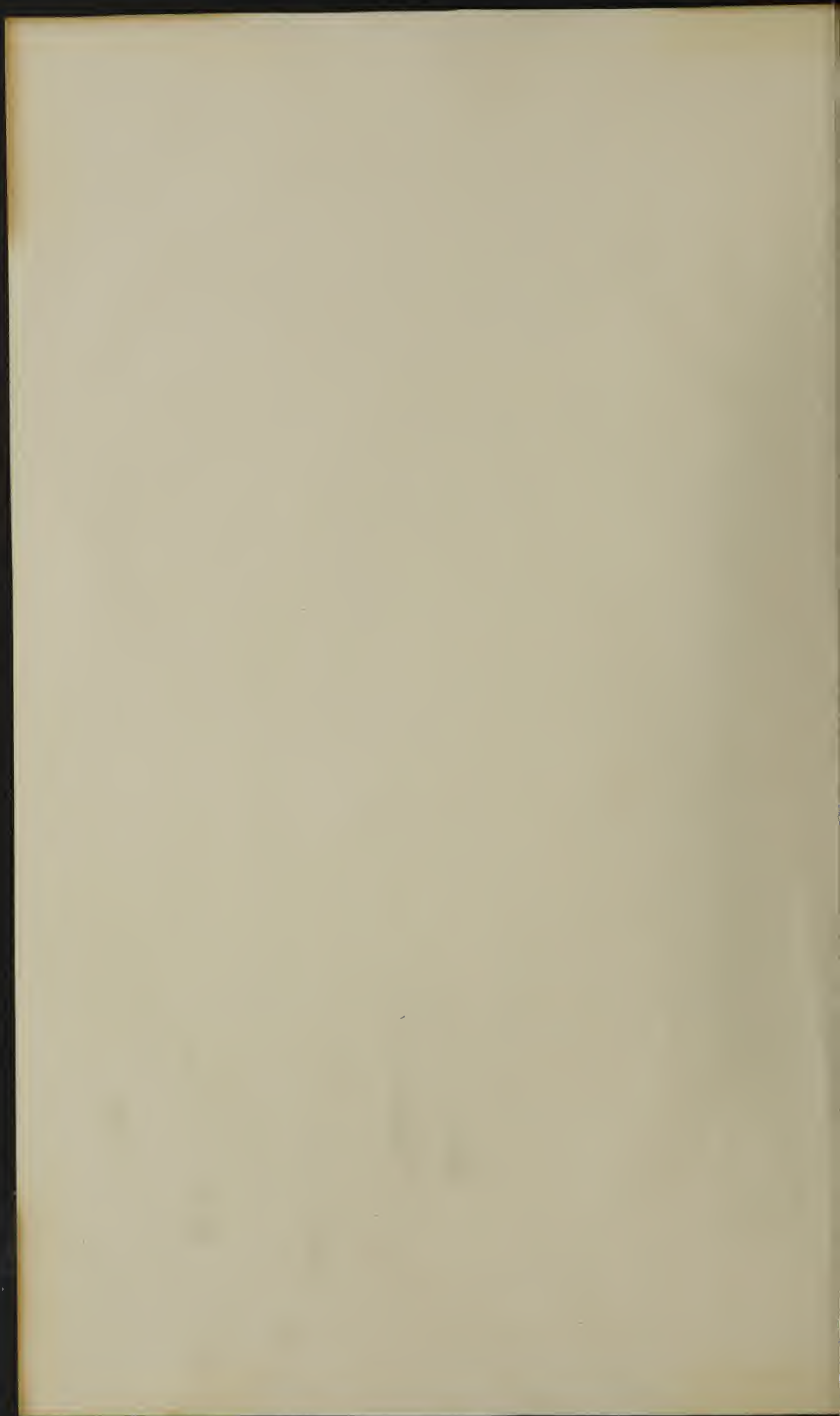
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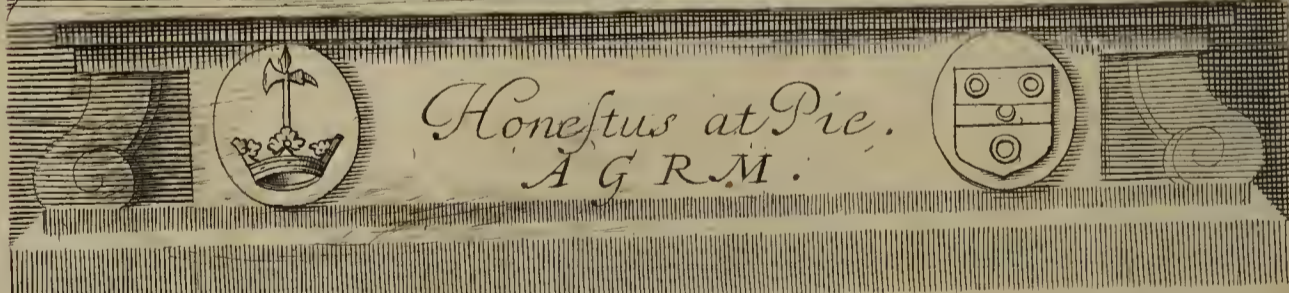






Æt. 70. 1683.

R. White sculp.



S<sup>r</sup> John Pettus of Suffolk Kn<sup>t</sup>. 1641  
One of the Dep<sup>ty</sup> Governors of y<sup>e</sup> Mines Royall.  
1651. Auratus Infletatus. 1679.

FLETA MINOR.

THE  
L A W S  
O F  
ART and NATURE,  
IN  
Knowing, Judging, Assaying, Fining, Refining  
and Inlarging the BODIES of confin'd  
M E T A L S.

*In Two Parts.*

The *First* contains *ASSAYS* of *Lazarus Erckern*,  
Chief Prover (or *Assay-Master General* of the Empire of  
*Germany*) in V. Books: originally written by him in the  
*Teutonick* Language, and now translated into *English*.

The *Second* contains *ESSAYS* on *Metallick Words*, as a  
DICTIONARY to many pleasing DISCOURSES.

By Sir *John Pettus*, of *Suffolk*, K<sup>t</sup>. Of the *Society* for the  
MINES ROYAL.

Illustrated with 44 *Sculptures*.

*Mal. 3. 3. Numb. 31. 31.*

Jehovah Chimista Supremus.  
Carolus D. G. Secundus.

L O N D O N .

Printed, for the Author, by *Thomas Dawks*, his Majesty's  
*British* Printer, at the West-end of *Thames-street*. 1683.

PLATE SECOND

THE

ARTS AND

1555

OF

ART and MANUFACTURE

IN

Know, ing, Judgment, and Industry, and  
and the giving of the same to the

METHODS

of the

The first part of this work is a  
Description of the several  
Manner of the same, and  
The second part is a  
Description of the several  
Manner of the same, and  
By the Author of the  
first part.



Printed in the Year 1700  
By W. Stansfeld, Printer, in the Strand

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T O T H E

Kings most Excellent  
MAJESTY.

S I R,

THE Materials of this Book are derived from your Majesties undoubted *Prerogative* to the *Mines* (in your Dominions,) of which *Metals* are made; Of them *Moneys*: And then honoured with your Majesties *Superscription*. And so by a *Christian Circulation*, the Possessors do, or ought to render to *Cesar* the things which are *Cesar's*.

Thus Your Majesty hath a double Right to the *Mines*, and to the Products of the *Chimical Art*, by which *Metals* are fitted for their Journey to *Publick Commerce*.

Herein I humbly offer my *Endeavours* to assist their motions, and onely to refresh your Majesties *Memory*, not to inform Your *Knowledg*: for (as 'tis hinted in the Title Page) Your Majesty is (in the *Science of Chymistry*, as in all *Sciences of Humanity*) *Nulli Secundus*.

These *Perfections* are evident in Your Majesties publick and private *Elaboratories*, from which pure *Justice*, and pleasing *Arts* and *Sciences* are communicated to Your *Subjects*.

In

*The Epistle Dedicatory.*

In these I have observed Your Majesties particular respects to *Chimistry* ( of an *Universal Extent,*) and thereupon I resolved to transplant this *German Twig* of *L. Erckern* (on that Subject) into Your Majesties Nursery; and Humbly Dedicate it to Your Majesty, (with my Additional) and also Humbly crave your *Acceptance,* as an *encouragement* to my *further Progress* in serving Your Majesty with more Fruits; but at present it is to shew, That I am intent in promoting the *Services* I owe Your Majesty, as well with my sedentary *Passive Pen,* as before with my *personal Active Duty,* having (upon some significant occasions) had the Honour to be known to Your Majesty near Forty Years.

Now, Great Sir, Wherein I am incapacitated to express my *Duty,* for want of *Ability* of *Mind* or *Body,* or *secular Fortunes;* they shall be supplied by my *constant Prayers* for Your Majesties Health, Happiness, and Serenity in Your Government, being

*Your Majesties most Obedient*

Feb. 26. 8<sub>3</sub>.

*and Humble Subject,*

JOHN PETTUS.



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To the Right Honourable, *George Marquess*, Earl, Viscount *Hallifax*, and Baron of *Eland*, Lord Privy Seal, and one of His Majesties most Honourable Privy Council; and Governour of the Society of the *Mines Royal*, and *Battery Works*.

My Lord,

Your Lordships free acceptance of the Government of the *Mines Royal*, hath encouraged me to add it to your Titles, and I hope without the least disparagement to your other Honours, deservedly conferred upon your Lordship by His Majesty.

It is a Trust of great Concern (and I doubt not but it will be so managed by your Lordship) and of Honour too, (as it hath been always esteemed) for (not to trouble your Lordship with very Antient Records,) I find that King Edward the Fourth did make Richard Earl of Warwick (who soon after was made one of the Governors of this Kingdom, during its Troubles) and John Earl of Northumberland, his Guardians and Governors jointly of all his Mines in England; and King Henry the Seventh made Jasper Duke of Bedford, and other Earls and Lords, his Guardians also of all the Mines in England (adding Wales.) And Queen Elisabeth, in the 10th. of her Reign, did form the Government thereof into Societies, by the Names of Governors, Deputy-Governors, and Assistants for the *Mines Royal* and *Battery-Works*, and then made Sir Nicholas Bacon, Lord Keeper, and other eminent persons, her Governors for England and Wales, (adding those within the English Pale in Ireland,) which Government did continue successively to the Earl of Pembroke, and others for some Years:

B

and

and after, his late Highness Prince Rupert was made a Governour; and your Lordship to our contentment, doth succeed him.

Now, my Lord, As for my self, I have been one of the Deputy Governours for above 30 Years, and do think my self obliged in point of Gratitude to the late Governours, and present Members (who were pleased unanimously to order a Contribution to the Charge of this Book, and for some former Favours,) to endeavour the advancing of their Concerns (especially now we have the Honour to be under your Lordships Regiment,) and therefore as an Introduction to my real Intents, I not only publish this, but by some Additionals, I shall study to make the Government more advantagious to the Society, and much more to His Majesty; and even to other Proprietors of Mines, wherein I have sat still some Years, because I found that I should be obstructed by some who studied the advance of themselves more than His Majesties Revenues; which I do not aim to do by any Oppressing Method, or projecting Humour (for I hate it) but by an honest just way, and I hope not displeasing to any, but such as nothing will please.

And these I shall in due time communicate to your Lordship; being so confident of your Lordships great Abilities, (join'd with your perfect Loyalty to your King, and Love to your Country) that your Lordship will not approve of any thing that I shall offer, if it agrees not with your Lordships sound Judgment and deep Wisdom, for which all who know your Lordship have an high value, and particularly

Your Lordships most humble

and obliged Servant,

JOHN PETTUS.

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To the Noble and Honour'd Subscribers  
and Contributors to this B O O K.

*My Lords and Gentlemen,*

I Did design to have publish't your Names in a way that should have more fully manifested your *Favours*, and my *Acknowledgments*; but this *Book* extending to above 50 sheets more than I design'd, or at first propos'd, took up my limited time, so as I must respit that intention, for I have not done with this *Subject*; intending not to trouble you or my self with Subscriptions, but such as have Subscribed to this, shall have notice when the next is ready; and if they approve of *this* so well as to take the *next* from me, it will be an additional Obligation to me, for I am prepared to go through the Body of this ART, upon these *Reasons*; First, *That it contains the Grounds and Maxims of most admirable Speculations*; and next, *That I may divulge their chiefest and most curious Experiments and Practicks*: Now, that which incited me to this, was occasioned from hence, That having caused *Erckern's* Books to be Translated about Ten years since; some eminent persons did perswade me (like the Story in *Bocalino*;) not to publish it, lest the Common sort of People should make an ill use of its impartments, alledging, That it was not well Translated: whereupon I betook my self to the *German* Language, and in a short time I was so much Master of it, That with the help of a *German* here, I did indeed find many Errors, and Corrected them, which answers one Objection; and I have Printed such a convenient Number as may answer the other; And yet I am not altogether satisfied therein; for, what hath made *Arts* and  
*Sciences*

*Sciences* flourish more in the time of King *Charles* the First, and now in His Majesties Reign, than their Majesties encouragements to the free communication of such things as had many Ages before lain secret? so that we hope that all *Pan- cerollus* his lost things may in a short time be found again.

We punish our selves by fixing and disputing on the *Theo- rems* of antient *Writers*, and thereby making things to be *Di- abolical*, which are only *Divine Favours* shewn us by *Natural Agents*, so as for want of knowing the true *Practicks & Ex- periments*, they are divulged either by umbraging *Sophisticati- ons*, or concealed under the Name of *Philosophical Secrets*, which, no doubt, but *GOD* intends for a publick and common *Good*: and this ill Fortune befell the *Unguentum Armarium*, as a piece of *Witchcraft*, 'till our *Eyes* were *inlightned*; and in many other things (which were they clearly communi- cated) such *Superstructures* would be raised from them, as might arive us to a kind of *Angelical Knowledg* in this *World*, and make us more apprehensive of our *Happiness* in the next: and therefore it shall be my study to unfold the *Metaphysical Notions* of this *SCIENCE*: by Pra- cticks especially about the *Philosophers Stone*, which study I value only for its fine *Pursuits* and *Products* of *Experiments*, but more, because the *Laborers* for it are, by their own Af- firmations, obliged to a *strict* and *religious* Life:

I shall trouble you no further at this time, but with my humble and hearty *Thanks*: and so subscribe my self

My Lords and Gentlemen

Your most humble servant

JOHN PETTUS.

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To my Worthy Friend, Richard Manlove, Esq; Warden of  
the Fleet.

S I R,

I Am here, a confined Person, for my being too kind to others, and too unjust to my self, and for not doing what was not in my Power to perform, by wanting the Justice of my Debtors, whereby I am rather a Prisoner to them than to my Creditors.

Yet I can dispense with all these, because they have occasioned my happiness, in your Acquaintance, and my contenting Retirement in this place, which was once a *Palace*, after, a *Staple* of Commerce, and long since and still, a *Repository* of our *Laws*: And now, like *Homers Iliads* in a *Nut-shell*, here are all sorts of Degrees, from *Prince* to *Peasant*, all sorts of *Professions*, from the *Doctor* to the *Novice*; all sorts of *Trades* and *Manufactures*, and all sorts of *Virtues*; but your *Prudence* doth still suppress the *Vices*.

And I ingeniously confess, that by yours, & your Ladies constant *Kindness* & *Indulgence* to my declining years, I have made it a *Colledge* of *Learning*, and so may other Gentlemen do (if they please) it being so qualified, that in an hours time there is no *Art* or *Science* wherein one may not be punctually instructed.

Now, Those that think themselves Prisoners to you are much mistaken, for they are Prisoners to the *LAW S*, and may make themselves *students* of *All-souls* in *Le Fleet*, of which you are *Warden*.

A Guardian-ship very needful for the People, as a Completion of *J U S T I C E*, in point of Restraints: For, (besides many other wise Considerations) they are good for Cooling the *Animosities* between *Creditors* and *Debtors*, and between the *LAW S* and *Contemners* of them, (and thereby prevents the *Effusion* of *Blood*, which hath often hapned) and for Curing the *sullen* and *contemptuous* Disposition of others to their Superiours.

C

For

For, I can truly say, That, by my patient Submission to them and my Misfortunes (being prepared with my 14 months Imprisonment in *Windsor* Castle, under the late *usurped* Power) I do now with more Satisfaction to my self, undergo this under a *Legal* Power, and thereby I affirm, That no Gentleman hath receiv'd greater *Respects* from you than my self, and therefore I take this Occasion to make my publick *Acknowledgments*, that it may be a *Guid* to other mens *Contentments*, for, as I have observ'd, That as you never were out-Hecter'd by *Affronts* or *Resistances*, so you were never out-done by *Civilities* or *Compliableness* to your *Methods*.

As to the *first*, I never gave Occasion, and as to the other, my studious *temper* complying with your *Love* to *Learning* have so won on your good *Disposition*, that I must acknowledge to my honored *Subscribers*, and others, that had it not been for your *Incouragement* and particular *Assistance* with your purse; (though with some *Inconveniencies* to your own Occasions) I could not have finished this *Book*, as now I have done, and therefore as one *Memorial* of your kindness, I have given it the name of *FLETA*, and in my Picture minted the word *infleturus* from this Place.

I could with delight to my self and others, spend more time on this *Subject*; but I must end with this *request*, That as you have given *House-room* here to the *whole Impression* of my *Books*, so you will please (in respect my person is restrain'd in *Execution* of the *Laws*,) to encourage it in its *Travels* abroad; and so not doubting of your *Favour*, I shall conclude with *Ovid*, (then, in my present *Condition*, but I will not punish my self with his *Tristibus's*,)

*Parve nec invideo sine me Liber ibis in* } *Aulam*  
} *Urbem*

Which I have thus Englisht,

*Go little Book, leave me, but make report,  
 Who treats thee best, the City or the Court.*

However you shall have the continuing thanks of

Your Obliged Friend and Servant

JOHN PETTUS.

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## To the Courteous READER.

**I** Think fit before you read this Book, to instruct you in the Method of it, so as you may read the whole, or part, as your leisure serves.

1. It is divided into two parts (as the Title mentions,) viz. Erckern's V. Books, and my Dictionary.

2. Whereas the Original of Erckern's 5 Books had no Numeral distinction of Chapters and Sections, I have divided them into Chapters and Sections, and Printed them before the Five Books, with numeral references to their chapters where they are contain'd.

3. Whereas the Sculptures had only Literal, and no Numeral Directions of their Contents, I have in the second part of the Contents before the Five Books, Printed the Contents of the Sculptures, with REFERENCES to the Pages where they may be seen and read.

4. Whereas the Original of Erckern's 5 Books bath no Coma's, Colons, Periods, Parenthesis, or Interrogatory Points, pertinent to the distinction of Words or Sentences (which are also wanting in many German Books) I have comply'd them to our way of Orthography, (which was no little trouble,) and therefore if the Reader find some few Omissions, they may upon that account be the more kindly dispens't with.

5. I do retain many antient and Saxon Words, upon the account of their affinity to the like Words which are still used among us, and these are hinted in the Dictionary.

6. In the Dictionary or second part, the first Words which I thought fit to explain, are in Capital Letters, and next, the Teutonick and Latine Words for those Capitals; (and other Languages,

Languages, as occasion requires,) and these I collected from G. Agricola, Alftidius, Cowel, Minshaw, and Skinners Dictionarys for the Teutonick, from Cooper and Holiock for the Latine; from Florio for the Italian, from Cotgrave for the French; and from Waltons Lexicon for the Oriental Tongues, which, with a German was all the help I had for the use of above 600 Words; but the two chief Languages, of which I make the greatest use, are the Teutonick and Latine, this from the old Romans, (who continued among us above 500 years) the other from the Saxons (who were mixt with us as long,) from both of which Nations we gain'd a particular knowledg of Mines and Metals, as may be evident from many Roman and Saxon Works, which remain here under their Names to this day; and many of our Monarchs, particularly Queen Elizabeth did think fit to desire the assisting SKILL of the Germans, to improve OURS; to prevent which trouble, I here publish part of their Art, and intend more.

Lastly, I have given it the Title of FLETA, which is borrowed from an eminent Lawyer, who whilst he was Prisoner in the FLEET, writ his Learned Book of the Common Laws of England, and thereupon (as 'tis said,) he call'd his Book FLETA (Cowel) to which I add MINOR, in submission to his great Learning, and for its affinity to the word MINER, viz. one who Labours in the Mines, as I do in Learning the Metallick Art.

To conclude, I have writ some things from Authentick Authors (too many to recite here,) and some from my own Conceptions and Observations; now as they pleased me in writing, so I hope they will not displease others in reading.

JOHN PETTUS.



THE  
P R E F A C E

O F

Lazarus Erckern,

To his five following B O O K S.



*So learn and understand the way of Assaying, Proving and Refining of Metalls, is an Excellent, Noble Science, and an Antient and profitable Art, long since found out by the Art of Alchimy and Chimistry, as also all other Works of the Fire, by which not only the nature of Oars and Mines, and what Metalls contained in them are known; but also how much there is in a Centner, or in greater or lesser Weights, and not only so, but this Art also teacheth how to Examine each Metal by it self, as whether there be any Adulterated or mixt Metal with it; what, and how much the same is, and then which way those Metals may be separated from such mixtures or adulterations, as also by several ways to cleanse and separate other incorporated Metals, so that they may be judged to be fine, clean and free from mixtures, therefore this Art is very profitable to Minerists and such as work in Mines and intend to have benefit by them, and such Artists must endeavour.*

Of the Art  
of Assaying.

A

by

## The P R E F A C E.

by all means to learn and exercise themselves in the same, that they may thereby reap a Profit to themselves and others, and preserve themselves from Inconveniencies and Dangers by their want of knowledge therein.

By this Art of Refining and the Profit that accrues by it, many good and rich Mines have been discovered, which otherwise would have lain concealed: and by the Advantage of these Discoveries many Cities and Villages have been built, Lands have been improved in their Values, and People thereby increased and plentifully maintained: As also great and mighty Trades and dealings with Gold, Silver, Copper and other Metals here, and in other Countreys exercised, and the Coiners of Coin and Minting Works have been multiplied by their Guardians and Masters; for from Gold and Silver, Money is made and much improved, so that the true Insight, Tryal and Examination of this Art, cannot be in any wise omitted or neglected, as that which is highly necessary to be known.

Rewarded  
by Princes.

And such Artists as have exercised themselves in the Knowledge of Assaying, and fundamentally and diligently practised the same, are by Princes, Lords and Communities thought worthy not only of great Thanks, but been also promoted and recompenced by them.

Mother of  
ARTS.

For this ART of Assaying is the very Inlet and Mother of many other honorable and profitable Sciences as Experience teaches us, and the more a man finds out, the more he is stir'd up to the contemplating and doing things of an higher Nature.

To know  
Metals ne-  
cessary.

So that the Knowledg of Metallick Oars and Minerals are first to be inquir'd into, namely, How each one according to their Nature, Figure, Form and Colour are distinguishable from each other: Which without great diligence and daily Practice cannot be known, because God the Almighty Creator, in the beginning of the Creation of the  
World

## The P R E F A C E.

World, hath plac'd Metals and Minerals in the Mountains, Valleys and Veins of the Earth, and causeth them to grow there: He hath also given to all and each of them an outward Form and Colour by which the one from the other may be distinctly known.

Secondly, *The Knowledg of the Fire is a principal part of this Science, and very necessary to be inquired into, that he may the better know how to govern the same, so that he may give no Metal more Fire than its due, but to every one its proportion of Heat and Cold, as necessity requires to add or take from it, in its Operation.*

How to use  
Fire in Me-  
tals.

*After the Knowledg of Governing the Fire, the Artists must have the Knowledg also of making all the Instruments and Furnaces for this, either by his own handy work, skillfully to prepare them, or at least to direct that they may be well made, whereby he may not be hindered in his working, but by his own diligence accomplish them.*

To make  
Instru-  
ments.

Furnaces:

*In like manner he must be careful in procuring good and just Scales and Weights, and to know also how to make them (in case such Artificers should be wanting) and fit them to all Metals, and he must have great Care in preserving them from Dust, and that they be alwayes pure and clean so that (as occasion serves) he may rely on the certainty of Proofs by them.*

Weights and  
Scales.

*Next to the former Directions he must be well skill'd experienced and exercised in the Art of Arithmetick, for the numbring and casting up Accounts (which to Assaying Coins and Refining Works are very necessary, and is one of the Master-pieces in this Metallick ART) And every Assayer must not only diligently learn this numeral Science (necessary to be known for the Proving of Metals or what belongs thereto) but also all such Arts and Sciences as may accomplish his full Designs therein.*

To be skill'd  
in Arith-  
metick.

Now

## The P R E F A C E.

*Now, though it would not have been unserviceable to have writ of all such things more largely in this Preface and Entrance to what follows, as also of the Rise and Springs of metallick Oars, and how they grow in the Mountains, Veins and Channels of the Earth, and how generated (of which the old and later Philosophers have had many different Opinions) as also of the Streams, Channels and their Entervals (and other Accidents which do discover and produce Oars, whereby the Miners do guide themselves in their Proceedings and Works.) Yet because it would have been too long and endless to recite the Opinions of Philosophers, and the various Operations of Miners: (in respect they do not agree in all things, and miss very much of their Aims, and have written many Books to little purpose) therefore, for brevity sake, I have omitted them, and proposed only my own Practice, for the better advancing this Metallick ART.*

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THE

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# The first P A R T,

Consisting of V. B O O K S.

The C O N T E N T S of the Chapters and Sections of the first BOOK.

C H A P. I.

Of Silver Oars.

**S** E C T I O N 1. The I. S C U L P T U R E Deciphered. 2. The II. S C U L P T U R E Deciphered. 3. The purpose of this first Book. 4. Why Silver in the first place.

C H A P. II.

How Silver Oars are distinctly known.

**S** E C T I O N 1. Of the difference in Assaying Oars, and of the several sorts of Silver Oars, as followeth. 2. Of Glassy Oars. 3. Of white Goldish Oars. 4. Of Horny Oars. 5. Of Red Goldish Oars. 6. Of Black Oars. 7. Of Ironish Oars. 8. Of Leadish Oars. 9. Of Glittering or Bismutick Oars. 10. Of Float Oars. 11. Of Azure or Mountain-Green Oars. 12. Of Flinty Oars many sorts. 13. Of Blanch, Cobolt, mispeckle or speckle Oars. 14. Of Glimmer, Wolferan, Talk, Cat-Silver and sparkling Oars. 15. Of Spelter or Spizy Oars. 16. Of Spady Oars. 17. Of Slacks and Copper-Stone Oars. 18. Of the wayes of Assaying them.

C H A P. III.

How the Assay-Ovens to prove Silver and other Metals are to be prepared and made.

**S** E C T I O N 1. Of special Ovens, adorning them not profitable. 2. The Assay-Ovens variously used to make good Loam. 3. An Assay Oven made by Norimbergers. 4. An Assay Oven made of Tiles. 5. An Assay Oven in which the fire is best governed. 6. Assay Ovens of Armour Plates. 7. The III. S C U L P T U R E Deciphered.

C H A P. IV.

How Muffles, Bottom Plates, Tests, and other small Potters Works are to be made for Assays.

**S** E C T I O N 1. The Assayers are to be skill'd in making them. 2. Of making the Loam for them. 3. The Frame for Assay Tests. 4. To make Muffles. 5. How the bottoms of them are to be framed. 6. Of drying and Calcining the Loam. 7. The IV. S C U L P T U R E Deciphered.

[ a ]

CHAP.

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CHAP.

Of the first BOOK.

C H A P. XII.

*To Assay Muddy Water coming from Springs of Silver.*

C H A P. XIII.

*How a true Lead-Grain is to be drawn from the Assay.*

**S**ECTION 1. Care in the Assaying. 2. The poorest Lead not without Silver.  
3. Of Copper to be added to the Lead Grain. 4. Another way to make  
a Lead Grain.

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1. THE Effigies of *Lazarus Erckern* the Assayer. 2. The Scales and Boxes of Weights. 3. Glasses for *Aqua Regis*, *Aqua Fortis*, *Aqua Vitrioli*, *Aqua Argentea* or Quick-Silver, &c.

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*Represents*

1 & 2. **T**HE Proportion of Touch Needles for Silver. 4 & 5. The Ingots to be compared with the Touch-Needles.

### Page 76. SCULPTURE IX.

*Represents*

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*Represents*

1. **T**HE Oven in which the Silver is to be burnt.
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3. The Wind-holes of that Oven, which drives the fire upwards into the Work.
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5. The Iron Ring or Mould, into which the Tests are to be beaten.
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8. The round Muffles for it.
9. The Ball and Hammer for making the Test.
10. The Servant that beateth the blink Silver into pieces, and the Instruments for it.
11. The Man (that takes care for the burning of the Silver) standing on the backside of the Oven.
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Page 90. *SCULPTURE XI.*

*Represents*

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2. The forged Fork.
3. The half forged Fork.
4. The filed Scales with the half Fork.
5. The two pearls, the one as a Pendula, the other on the top of the Tong in the Fork.
6. The end of the Beam, and the like is to be supposed for the other end.
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*Represents*

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Page 98. *SCULPTURE XIII.*

*Represents*

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*Represents*

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2. The middle Floor, whereon that which goeth through the Ratter doth fall.
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5. The Man that stands on a board, and out of a Wheel-barrow throws the matter or Oar into the Tunnel which guides it into the Ratter.
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Page 108. SCULPTURE XV.

*Represents*

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Page 112. SCULPTURE XVI.

*Represents*

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Page 123. SCULPTURE XVII.

*Represents*

1. **T**HE Athanor or great Furnace. 2. The Ovens on the sides of it. 3. The Earthen Receiver for it. 4. The Earthen Helmet for it. 5. The blind Helmet with a Pipe, on which Water may be poured. 6. He that fitteth the matter. 7. He that preffeth the Quick-silver through a Leather. 8. The lower part of an Iron Jug or Receiver. 9. The upper part of it. 10. The Leather purse whereby the Quick-silver may be prest out. 11. He that causeth the Gold to melt by help of the Bellows. 12. The pieces of Metal.

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Page 153. SCULPTURE XIX.

*Represents.*

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Page 158. SCULPTURE XX.

*Represents*

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*Represents*

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3. The Mouth-hole under the Grate.
4. The Grates in the By-Oven.
5. The form of the By-Oven.
6. The Instruments to open or shut the wind-holes.
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8. The Pins for the Registers or wind-holes.
9. A Semi-Circle piece of Wood by which the Athanor is to be made.
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11. The Man that tends it.
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*Represents*

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3. How the Bottle is to be placed in the Oven.
4. The Glas Helmet made for it.
5. The Recipient or Receiver.
6. The Pot full of materials prepared.
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8. The Man that tends the Athanor and By-Ovens.

### Page 177. S C U L P T U R E XXIII.

*Represents*

1. THE Tower of the Athanor.
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3. The Glas Receivers.
4. The earthen Jug or Receiver.
5. The Oven for the Retorts.
6. The little Receivers to be added to the great Receivers that there may be room for drawing the Spirits.
7. The long Oven.
8. The By-Oven in which the Spirits are to be forc't into the *Aqua Fort.*

### Page 185. S C U L P T U R E XXIV.

*Represents*

1. THE Tower of the Athanor.
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4. The Receivers which are laid to the Helmets.
5. How the *Aqua Fort.* is by them to be drawn from the Silver.
6. An Iron Instrument with which the Glasses are to be taken out and in.
7. The Man that attends the Operations in the Glasses.
8. Another Man to attend the other Glasses upon shelves.
9. The Ingredients prepared in a Dish or Pan.

### Page 200. S C U L P T U R E XXV.

*Represents*

1. THE inward part of Wind-Ovens.
2. The outward parts compleated.
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5. A single Crucible and cover to it.
6. The Iron Tongs by which Crucibles are put in and taken out of the Fire.
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Vessel into which the stuff or melted matter is to be cast. 9. The Man attending the Wind-Ovens.

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*Represents*

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Page 207. SCULPTURE XXVII.

*Represents*

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Page 222 SCULPTURE XXVIII.

*Represents*

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*Represents*

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Page 247. SCULPTURE XXX.

*Represents*

1. **T**HE Melting-Oven to try Copper Oars from Copper-Stone. 2. The luting it with Clay. 3. The buck't or washt Oar. 4. The little Ovens in which the Cop-

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Copper-Oars are to be proved, with ordinary Bellows, and a Man to attend them. 5. The Bellows as they are used. 6. A Copper Instrument (with a Neck) in which water is put and set over the Fire, and used instead of Bellows (called Philosophical Bellows, see *Lib. 1. Sculp. 2.*) 7. The Pot in which the Flux is to be made. 8. The Assay Crucibles. 9. The Block, Hammer and Pieces to be beaten.

### Page 265. S C U L P T U R E XXXI.

*Represents*

1. THE Copper and Lead Pieces weighed, and a Man that attends them. 2. The Oven for melting fresh Oars. 3. The Copper Pan into which the fresh pieces are to be cast. 4. The form of the fresh pieces melted. 5. The Melter. 6. The Vault which receives the dust and smoak. 7. The little Door out of which the dust is to be cleansed. 8. The Wheel that brings in Water with the Tub to receive it.

### Page 274. S C U L P T U R E XXXII.

*Represents*

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### Page 278. S C U L P T U R E XXXIII.

*Represents*

1. A Drying Oven. 2. An Oven soon made, according to the *Hungarian* way. 3. A common ready Harth attended with two Men. 4. The Kinstocks which are to be pickt with an Iron Tool and beaten by a Man. 5. An Harth for spizing, according to the *Hungarian* way. 6. 6. 6. The Copper Cakes, quench't in a Cistern of Water by a Man.

### Page 284. S C U L P T U R E XXXIV.

*Represents*

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### Page 288. S C U L P T U R E XXXV.

*Represents*

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the beaten *Calaminaris* Stone, which is to be mixt with Copper for the making Brass.  
 5. The Tongs by which the Pots are to be set in and taken out. 6. The Wind-holes  
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 place for the Master that sets in the Pots.

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 Man that beats the Oar. 9. The pieces of Oar and Cinders. 10. An heap of Char-  
 coal. 11. The Water-Troughs to wash the Oar in. 12. The Pipes by which the  
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Page 307. SCULPTURE XXXVII.

*Represents.*

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3. The melted Spelter that is to be made clean in the Iron Pans, and the work-  
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*Represents*

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Page 329. SCULPTURE XXXIX.

*Represents*

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 of

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of the Lees. 5. The ninth Tub from which the Lees run into the Kettle. 6. The Oven wherein the Kettle stands. 7. The Kettle. 8. The Iron Door by which the wood is to be put into the Oven under the Kettle. 9. The wind-hole, in the bottom of the Oven. 10. How the Oven may be seen in the inside. 11. The Iron Grate on which the wood lays. 12. The door into the working-House.

Page 332. SCULPTURE XL.

*Represents*

1. THE long narrow Tubs wherein to cool the Lees. 2. The Oven wherein the Kettle is placed. 3. The Master which makes and lets out the Salt Petre and puts it into separating Baskets. 4. The separating Baskets. 5. The Tub out of which the strong Lees run into the Kettle. 6. The Melting Vessels in which the Salt-Petre improves. 7. The 4 Kettles standing on the ground, wherein the Salt-Petre also improves it self. 8. A strong Tub into which the Salt-Petre is to be cast, as it improves.

Page 341. SCULPTURE XLI.

*Represents*

1. THE fore-part of the Salt-Petre-House wherein the Lee Tubs do stand. 2. The back part of it, wherein the Kettle and the Oven are placed and wherein the Salt-Petre is to be boyled. 3. The old pieces of Earth, out of which Salt-Petre is to be made. 4. The wood used for boyling it. 5. The Servant that shaves and fits the Earth for boyling.

In the second Part of E S S A Y S,

THESE are the XXIV. *English* Letters, curiously Cut in Wood: and two more SCULPTURES Engraven in Copper. *viz.* under the Word *Limbeck* one, and under the Word *Load-stone* the other.

THE

THE best Artists may commit Mistakes or Errors, but they are Pardonable, when they proceed not from a willful and careless Neglect, and therefore 'tis hoped that the Ingenious Reader will connive at the want, or misplacing of Comma's, Periods, or Parenthesis, and for the rest they are here set down, that there may be no Mistake in the Sense of the Author.

Age 12: Line 24. for Essay, read Assay-Oven. p. 38. l. 15. r. Petre. p. 63. l. 13. r. Needles. p. 72. l. 2. r. Blink. p. 75. Fig. 7. r. a compleat unused. p. 89. Fig. 7. r. the Fork and Pendula. p. 103. l. 24. r. a black Hair Sieve. dele Sicher Troy. p. 114. l. 27. r. rough Stones. p. 118. l. 15. r. Sandiver. p. 154. l. 3. for washeth r. weighed. p. 167. l. 16. r. which you. p. 171. l. 15. for Rager. Linseed. p. 181. l. 14. r. Silver. p. 186. l. 14. r. hath. p. 189. l. 2. r. put in. p. 242. l. 17. r. with which. p. 252. dele 12. Necessary r. Profitable. p. 280. for Loths r. pounds. p. 287. Fig. 2. r. How the. *ibid* Fig. 6. r. Wind-holes. p. 313. l. 2. r. Tinby. p. 333. dele 3, 4, 5, 6, 7, 8. r. 4, 5, 6, 7, 8.

THE best Artists may commit Mistakes or Errors, but they are Pardonable, when they proceed not from a willful and careless Neglect, and therefore 'tis hoped that the Ingenious Reader will connive at the want, or misplacing of Comma's, Periods, or Parenthesis, and for the rest they are here set down, that there may be no Mistake in the Sense of the Author.

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LA-



Lazarus Erskerus

CAP. I.

*aliàs*  
Erckern.

B O O K I.

CHAP. I.

*Of Silver Oars.*

Sculpture I.

Section 1.



Deciphered.

The *Assayer* 1. the *Scales* 2. the *Cases for Weights* 3.  
*Glasses* for Aqua Regis, Aqua Fortis, Aqua Vitrioli,  
Aqua Argentea or Quicksilver, &c. 4.

B

Sculpture



Deciphered,

1. The form of an *Athamor* or great *Furnace*.
- 2: The *Forceps* or *Tongs* and *Fork*.
3. The *Coppel* or *Test*, with *Philosophers Bellows*.
4. The *Digestive Pot* with its *Cover* and *Fire* about it.
5. A cover'd *Crucible*.
6. The long *Bell*, or *Matras-Glass* on a *Sand Furnace*.
7. The *Wind Furnace* with a *Blow-pipe*.
8. A *Furnace* with a *Copper head*, and its *Receiver*.
9. A *Furnace* with a *naked* and open *Fire*.
10. The *Pestel* and *Mortar*, with one beating the *Metals*.
11. The *Owl's Head*, or another form of a *Cover* to the *Figure 8*.
12. A *Retort*.

THIS



HIS first Book speaks of *Silver Oars*, CAP. I. how they may be distinguished by their several Sorts, and afterwards by *Assay-Scales* and *Assay-Tests*; Of *Muffles*, *Coppels*, and of *Clar* for *Lead*, of *Lead-Glass*, of *Fusion-Powder*, of *Ballances* and *Weights*, and

Section. 3.  
The Purpose of the Book.

how a *Lead Grainer* may be made, and then how every particular sort may be certainly assay'd or tried, as also of *Slake* and *Slake-stone*, *Flakes* and *Hard-Work*, of *Laech-Speiße*, *Black Copper*, *Pagment*, and of *Granulations*; as also of *Planches* or *Plates of Silver* and burnt *Silver*, with a fundamental Information how to burn *Silver* in the common way, and under the *Muffle*: as also the preparing and making *Tests*: and how to cast *Silver* which is *Tuff* or *hard*, as well as that which is not *tuff* or more *ductile*: also how to assay *Tin*, *Iron* or *Steel* for *Silver*, and to know what any *Silver* or *coined Mony* is worth: and to make *stroking* or *touching Needles*, or *Ingots of Silver* for distinguishing the *fine* from the *less fine Silver*.

See the Dictionary.

Now, because I have in this *Treatise* first begun with the Description of *Silver Oar* and its *Tryals*, some may wonder why I did not rather begin with *Gold*, (which is treated of in the *Second Book*) and why I did not give *Gold* the Preheminence, it being the highest and chiefest *Metal* of the *Earth*, and so by right it should have been first treated of.

Why <sup>4.</sup> *Silver* first treated of.

Therefore I think fit to inform the *READER* that I have not done this without good Reason; For, from *Silver Tryals*, all other *Assays* and Preparations of *Instruments* do flow, as out of a *Fountain*, and have their *Rise* from thence; for which cause I have judg'd it necessary, in the first place, to give information of the same, and to place it in this first *Book*, because it is

CAP.I. to the Honour of the Crown of *Bohemia*, and bordering Countrys in *Germany*, viz. *Miechfin*, *Sachsen*, *Sbesren*, *Manhren*, and other Countrys where there are many *Mines* containing good Quantities of *Silver*, and many *Miners*, *Gardians of Mines*, *Refiners*, *Provers*, *Smelters* and *Melters*, who exercise themselves in proving of *Silver-Oars*, and of such Metals as contain *Silver* in them, and yet because there are many in these parts who have not gained the true Knowledge thereof, or have not in all things pertinent to this Science, obtained a fundamental Information, I have proposed to my self to be serviceable to such, and therefore I have more largely treated of *Silver*, and its *Tryals* than of any other *Metals*, and am not willing to leave this unmentioned in this entrance of what I am to write.

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## CHAP. II.

*How silver Oars are distinctly known.*

I.  
Section



*Silver Oars* are found to be of many sorts and Colours, yet if they be not very fine, they are not to be judged by their Looks (how rich soever they are in *silver*) and therefore 'tis proved by Artists (who have diligently search'd into this *Science*, and by them found out many years past, as also by others who have since improv'd this *Art*) that the worth of every *Oar* may be certainly found out, so that the very *smelting*, *melting*, *refining* and account thereof, may be demonstrated both as to its *worth* and the *Charges*.

Now

Now it is here necessary to be known, that so many CHAP.  
as there are *Sorts* of *Silver Oars*, so many are their *Natures* and ways of *melting* and *refining* them; and therefore the *Tryals* of *Silver Oars* must be ordered according II.  
to the *Nature* of the *Oars*, because the *hard*, *harsh*, *gross* and *crude Oars*, cannot be proved like those of an *easier Fusion*; or of a more *mild*, *subtil* and *ductile nature*, because, as an *Oar* proves either *harsh* or *hard* of *fusion*, so it must be help'd (in the proving) by the *Government* of the *fire*, or by other wayes; as; by much *Experience* in proving such *Oars* have been and may be discern'd according as they *melt* in the *fire*: so that if there be not a knowledg of the *Nature* of an *Oar* before *melting*, and how it will do in the *fire*, such an *Oar*, cannot be melted to profit.

Difference  
of assaying  
Oars.

Now for the better attaining the knowledg of the *Difference* of *Oars*; as, which are of an *easy*, and which of an *harsh* and *crude Fusion*; the most excellent and experienced *Miners* do give every *Mine* (and *Oar* from thence) *Names*, according to their *Natures*: all which according to the *Terms* used by them are hereafter named.

First, there are reckoned to the *Easy-flowing Silver-Oars*, these *Nominall distinctions*, viz. *Glass-Oars* (as the cheifest of the *leaden Coloured Oars*) almost to be compared to the best *digested Silver*, for it doth not loose above a sixth part in the *fire*, and the rest is pure and *good Silver*, and this *dig'd Oar* is accounted the best *Silver Oar*.

Section  
2.  
Glaß-Oars

Also there is found *white-Goldish Oar*, not that it contains *Gold*, but because it is good in *Silver*, it hath this name in respect of its *Goodness*.

3.  
white gold-  
ish Oar.

Also the *Horny Oar*, (which is called so from its transparency or rather lucidation like *Horn*) and is very *rich* in *Silver* next to the three last mentioned *Oars*.

4.  
Horn Oars

C

There

CHAP. II. There is a *Silver-Oar* which is *Brown-red* (almost like *Cinabar*, but not so light) and this they call *Red-goldish Oar*, and this doth yield above *half Silver*, and it is found that these *Oars* do break like one another, and the difference not easily discern'd.

Section.  
5.  
Red goldish  
Oar.

6. As for all *Oars* which are *gray* and *black* in breaking and withall heavy, they are often *rich* in *Silver*, but such as break *black* and *light*, or *brown* and *yellow* are not allwayes *rich*, and it happens often that there is little or no *Silver* in them.

6.  
Black Oar.

7. All *Ironish brown* and *yellowish streamy Oars* are from decaying *Mines*, pierc'd by cold *winterly Winds*, and these contain some, but are not rich in *Silver*.

7.  
Ironish Oar

8. Also the *leadish*, or *Oar* that looks like *mud* (and therefore call'd *muddy Oar*) is somtimes *rich* and somtimes very poor in *Silver*, and indeed all *leaden*, *horny*, *stony Oars*, if they be *yellow*, *white*, *gray*, *black*, *brown*, *red* or *green* do not contain in themselves (if no other *Oar* be mingled with them) much *Silver*, and for the most part none at all.

8.  
Leadish Oar

9. Also there is reckoned among the *Easy-flowing Oars*, all such *Lead-Oars* as are of a *bright*, *glittering*, *shining* Nature, or of a *gray*, *brown* or *white Colour*, yet these of themselves alone have little *Silver*, but the small *flaky glittering* or *Wismet Oars*, from the *Mines* in *Bohemia*, as also the much *flaky*, *shining Oars* from the *Mynes* of *Fryburgh* in *Misnia*, do contain from 6 to 10 ounces in a centner.

9.  
Glittering  
Oar.

10. Also all *float* or *Easy-flowing Oars* that are *Yellow*, *white*, *brown*, *blew*, *green*, or *gray*, do contain near that proportion.

10.  
Float Oars  
many Sorts.

11. Also *Copper-grass Oar* or *Copper* of a *Mountain green*, or *Copper glass-Colour* do hold some *Silver*, but the *Course Oars* of an *Azure*, *Mountain-Green Colour*, are comonly poor.

11.  
Azure or  
blew Oar.

Of Silver Oars.

7  
CHAP.  
II.

In fine, all *Silver Oars* in all sorts of *Mynes* free from *Flint, Blent, Cobolt, Mispickle, Glimmer, Wolferan, course spelter* and *Wismet* (or be *spizy* and *Copery*) are called, fast flowing *mild Oars*.

See the Dic-  
tionary.

Section.

12.

*Flinty Oars*  
*many Sorts.*

On the contrary, all *flinty Oars* are reckoned among the *harsh, gross* and *hard flowing Oars*, and of these *Oars* there are also several sorts, namely the *gross Flinty-Oar*, the *water flinty-Oar*, and the *square flinty-Oar*, these contain *little Silver* (and the most part of them none) or not above half an ounce in a *Centner*: also *Copper-flinty Oars* that are *yellow like Brass*, also the *Brown* and *Blew-staind-Flinty Oars*, they do contain much good *Copper* (as may be Seen in the third Book) but such *Oars* contain *little Silver*, yet one sort more than another.

There are also *rich-copper-Flinty Oars* which have *no Silver* but the *Blent, Cobolt* or *mispickle Oars* (as in Section 11.) if they be *speckled* or *spotted* with round *black* or *gray spots*, they are sometimes *rich* in *Silver* and sometimes *poor*.

13.  
*Cobolt, blent*  
*mispickle*  
*Oars.*

Also all *common-white Glimmer* or *wolferan* (as in Section 11.) or *glimmering* or *sparkling Oars*, or *Talk* or *Cat-silver* are very *poor* in *silver*, yet the *black Glimmers* are sometimes *rich*; but for the most part all such *glimmery Oars* are commonly *poor*, so as I account these but as *Patterns* to other metalick *Oars*.

14.  
*Glimmer,*  
*Wolferan,*  
*Talk, Cats-*  
*silver and*  
*sparkling*  
*Oar.*

Also all *course-Spelter, spizy* or *coppery-spizy Oars* (as in Section 11.) or the like kind, they are commonly *poor* in *Silver* and contain none at all.

15.  
*Spelter and*  
*spizy Oars.*

Also all *spady Oars* (or such as may be dig'd with a *Spade* (if they be *red, green, yellow* or *white* (if there be no other mixt *silver-Oars* with them) for the most part do contain little or no *Silver* in them.

16.  
*Spady Oars.*

Also there is reckoned among the *harsh, or hard-flowing Oars*, the *raw slack-stone*, and *copper-stone, spelter*, be-  
ing

17.  
*Slack and*  
*Copper stone*

CHAP. II. ing alike in cleaving and splitting of Furnaces which proceeds from the stirring of the flinty parts, as also from the scummy part in melting them.

Section.  
18.  
The Ways of  
assaying  
them.

But how the *Proofs* of the above-named *soft-flowing*, as also of the *hard-flowing silver Oars* are to be wrought, I shall by the following **DISCOURSE** distinctly and exactly inform the **READER**.

Now, because that in many places there are no *Workmen* who can well make *Instruments*, belonging to the proving of these *Oars*, I will for the better *Information*, shew first what is chiefly necessary to be done in such proofs, both in the whole, and in parts; as also what matter or stuff is to be used about them; as also what *Instruments* are to be made and prepared for them.

### CHAP. III.

*How the Assay-Ovens to prove Silver and other Metals are to be prepared.*

Section.  
1.  
Special  
Ovens.



Adorning  
them.

**H**ERE must be *special Furnaces* (for *Assaying*) made of good *Potters Clay*, and bound with strong *Iron wyre* or *Hoops*, that they may not fall asunder by reason of the strong heat which they must endure. But some diligent *Assayers* which intend to carry on their *Work* effectually, do form and adorn their *Furnaces* fairly and comely, so as they may be pleasing to the *Sight*: This indeed do's give them an adornment, but there is no more done with it, than with a *Common Furnace* (that is made well, though plain.)

Now there are many sorts of *Assay-Ovens* which *Assayers*



*sayers* made use of according to their several wayes of working, but this is to be noted, That in one Oven, the Fire is to be better governed than in another, either by heat or cold, as the difference may be seen in the following *Sculpture*: But I intend to mention first, how the *Ancients* have made their *Furnaces*. CHAP.  
III.

The Common *Assay-Ovens*, in which the *Ancients* have made small *Tryals*, they have caused to be made square, of strong iron Plates about fifteen Inches wide below, and sixteen Inches high, and sloping from below to the top, so that the square was about ten Inches at the top, and this Square had no Bottom, but in the Fire part it had a Mouth-hole (of four Inches and a half wide) and the other three sides had each of them at the Bottom a *wind hole*, four Inches long, and one and an half high: there was also every where about the plate, holes cut into it, so that it was ruffe and sharp for the *Loam* to stick the better to the luting of their *Furnaces*. Section  
2.  
*Iron Assay  
Ovens of the  
Ancients.*

Now to make such a special good *Loam*, (as will hold well in the fire) take good and well wrought *Loam*, beat among it *Flocks of Wooll*, or *Horse-dung*, *Blood of Oxen*, *scales of Iron* and common *Salt*, with which lute the *Furnace* two inches and a half thick, let it dry, then take small ground *Venice-glass*, *Bone-ashes*, and a small quantity of *Loam*, mingle it well together, and plaster it all over the inside of the *Furnace*, let it dry well, then make a gentle fire in it, that it may be *neald*, and when the *Furnace* is to be used, there must first be a smooth fire-place, and upon that *Copell-Ashes* are to be laid the breadth or thickness of a finger, and this on the *Furnace* must be placed; and in the *Oven* upon the Fire-place a *Muffle* (which is formed as the following *Sculpture* doth shew:) and thus the *Assay-Oven* is made ready: and when there is any To make a  
good Loam.

D

Tryal

CHAP. III. Tryal to be made of the *Furnace*, after it is well glaz'd within by the last plastering over of the *Furnace* with the *Venice-glass* and *Ashes*, it will last the longer.

And when the *Furnace* in length of time is quite burnt out, then the old *Loam* is only to be knock'd out, and fresh put in the room thereof, and proceed as before.

In such a *Furnace*, he that knows well the Government of the Fire, and is an experienc'd *Assayer*, may make all manner of Tryals, only the Registers are sooner stopped with the *Ashes* than the *Furnace* with the two mouth-holes, of which there will be information hereafter.

Section. 3.  
Norinberg  
Assay Ovens  
made of  
Potters  
Loam.

Some *Assayers* do use in their tryal of *Furnaces* (which are made of *Potters Clay*, and formed like the above-named *Furnace*) and tye them with wyre, and set them upon a foot which is broad and hollow, and hath in each of the four sides wind-holes (as the following Sculpture will shew.) And in this *Furnace* it is more easy to govern the Fire, than in the above named *Furnace*, because the *wind-holes* in that *Furnace* (which are in the foot) do stop themselves easily; and such *Assay-Ovens* are called *Proof-Ovens* of *Noringberg*, and the *Muffles* appertaining to them, are also seen in the Sculpture:

4.  
A slight  
Assay Oven  
of Tiles.

But if a man should be in a place where no *Assay-Ovens* are to be had, and yet would assay a few tryals in haste; in such case, Take only a few *Tyles*, place them together in a square, and leave in the sides *Wind-holes*, and in the fore-part leave also a *Mouth-hole*, and with a *Pipkin* cut in two, make a *Muffle* in it, and in such *Furnaces* Assays and tryals may be well performed.

5.  
Assay Ovens  
in which  
the fire is  
best govern'd.

But in such *Assay Ovens*, in which most commodiously Assayes may be made, and in which the Fire may be right and duely govern'd, also as such as are not easily stop'd

stop'd with ashes, and in which all the Tryals (that may be made in any Furnace) may be tryed, they are to be made thus, *viz.* eleven Inches wide, and sixteen inches high, which is the full hight of the *Assay-Oven*, when you have measured eight inches high, then work it a little in, also that the Oven at the top may remain seven inches wide, and the thickness must be one inch and a half, and the lowermost Bottom three quarters of an inch thick, then measure from the bottom three inches high, and four inches and a half wide, which is for the lower Ovens mouth, then measure two inches above the lower *Mouth-hole* (which is for separating of the upper and lower Ovens mouth :) in like manner measure the height, three inches and a half, and four inches wide, then after a separation of an inch thick, make the uppermost *mouth-hole* about the bigness of a little finger, so that from the middle of the hole to the top of the Oven there may remain yet six inches and an half, then on both sides of the *Ovens-mouth*, towards the corner, measure three quarters of an Inch: and make there two holes a pretty-big Fingers widness, which must go strait through the Oven, as also the like behind: when all this is done, you must then also make a *declination*, from whence the *Ashes* may fall; which must stand two inches and a half from the bottom, and two inches and a half from the sides of the *Furnace*, and the *declination* must stretch hollow upward from the bottom, six inches and an half: Only observe this, That if you intend to make any thing of *Clay*, then you must add so much as the *Clay* useth to shrink, because one sort of *Clay* doth shrink more than another, but most commonly *Clay* doth shrink the tenth part: When this *Assay-Oven* is also finished, and is yet soft, then there must be edges cut in it, in which the *Iron-bonds* or wyer may lay, after that, let it dry well in the Sun, and then let it be

CHAP.  
III.

→

CHAP. be hard baked in a *Potter's Furnace* or *Brick-kiln*.

III. There are also in like manner *Assay Ovens* made, which outwardly are of a square form, like the above-named *Furnace*, and are made very neat and clean, of strong *Armor-plate*, and writhen with *Ironpins*, on which the *Lute* may stick well, and artificially brought together, also that such a *Furnace* may be taken asunder into five pieces, which *Furnace*, like to that of *Iron-plate*, must be neatly *luted* with a good and firm *Lute*, and to the strong plate of *Iron* at the outside of the oven, there must be little plates to put forward and backward in small *Crevices*, and so according to necessity the *Trial* may be well made: Of such *Assay Ovens* there is much *Estimation* made, but there can no more be accomplished with it, than in one of the other mentioned *Furnaces*, if only an *Assayer* have well the knowledge of the *Fire*, after which all *Proofs* are to be governed, then can he, without question, do well in all these *Ovens*.

Section.  
6.  
*Assay Ovens*  
of strong  
*Armor-*  
*plate.*

In this following *Sculpture* is to be seen how this and the afore-named *Ovens* are to be formed, which is thus

Deciphered.

1. *An Assay-Oven used by the Antient Refiners, joy-  
ned with Iron Plates.*
2. *An Assay-Oven used by the Norinburgers (in Ger-  
many.)*
3. *The Foot of it.*
4. *An Assay-Oven made of Tiles joyned together, which  
may quickly be done.*
5. *An Assay-Oven made of Potters-Loam, and fastned  
with Iron Bonds.*
6. *The upper mouth-hole of it.*
7. *The lower mouth hole of it.*
8. *The holes for Iron-barrs to be put in.*
9. *An Assay Oven made of Armour-plates.*

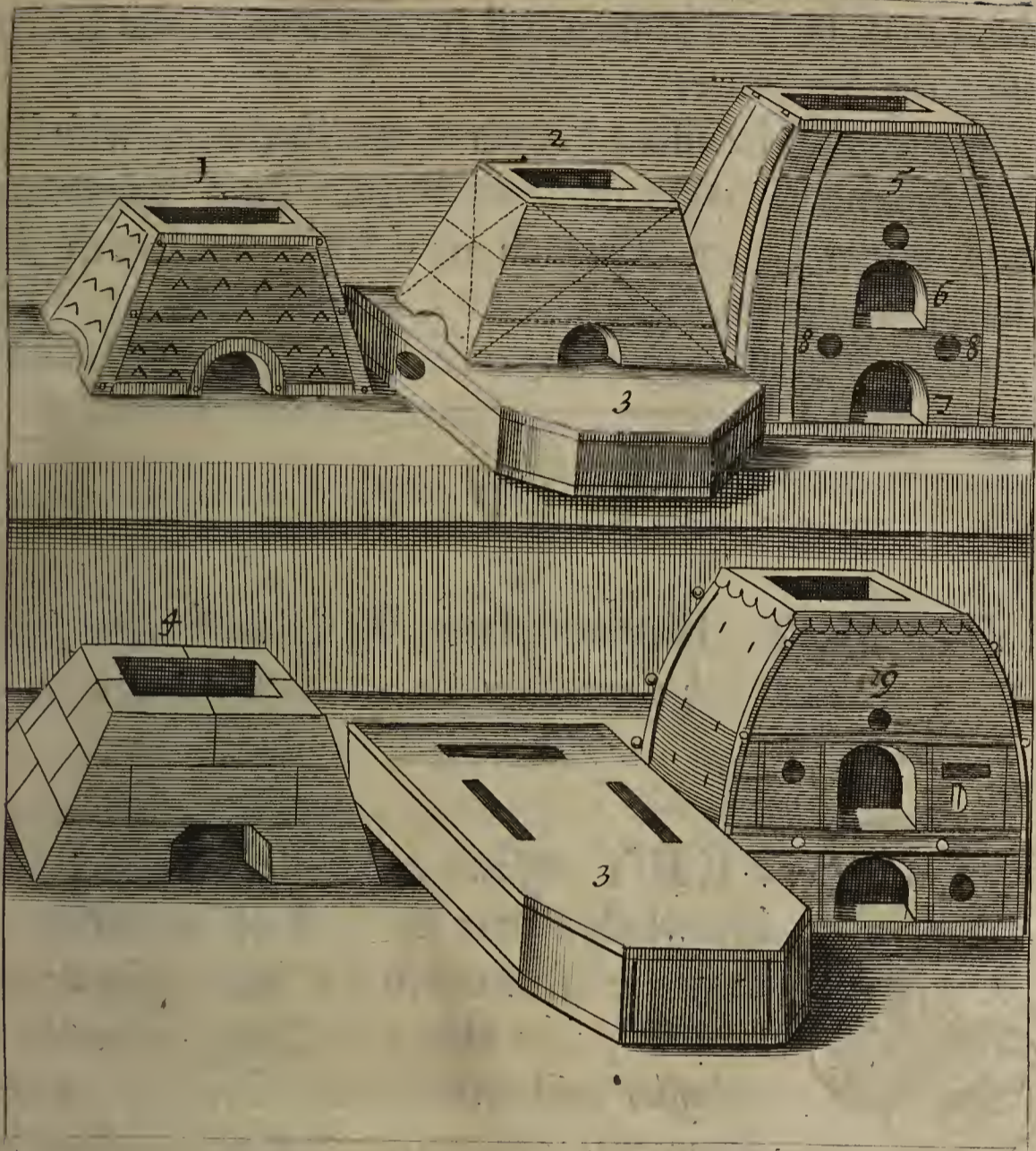
Sculpture

Of Silver Oars.

Sculpture III.

13

CHAP.  
III.



When any one of these *Assay-Ovens* is thus prepared, then cause two *Iron-bars* to be made of an equal length, which must go through the holes that are between the upper and lower *Mouth-holes* (Figure 6 and 7) and stand out about three Inches, on the out-side of the *Oven*, on which the plate must rest before the upper *Mouth-hole*, and cause a *bottom-plate* to be made no bigger than from the *Bars* to the lower part of the upper *Mouth-hole*, and so broad that it may reach a little above the *Iron-Bars*, and from the bottom-plate towards the sides, so as there may remain near an inch of room on the Back part of the *Furnace*, whereby the *Wind* may pass through it into the *Oven*, so that the fire may do its work.

E

To

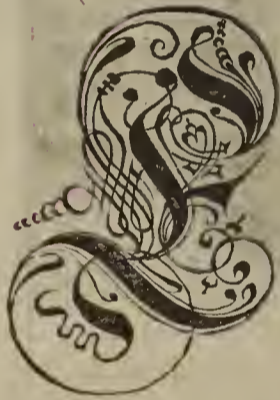
CHAP:  
IV. To this *Assay-Oven* there belongs singular *Muffles*, which may be seen in their full proportions, in the fourth following *Sculpture*.

There must be also a *Cover* to the *Furnace*, with little *Instruments* to be made of *Potters stuff*, to govern the fire, the *Forms* of which are also in the fourth following *Sculpture*.

## CHAP. IV.

*How Muffles, Bottom-plates, Tests, and other small Potters-Work (necessary for Assayers) are to be made.*

Section:  
1.



VERY *Assayer* ought to have so much knowledg, that in case of necessity he may be able to make his *Assay-Ovens* himself, as also his *Tests*, *Crucibles*, *Muffles* and what other *Utensils* or *Instruments* are daily used as necessary to *Assaying*, because there are not in every place *Masters* of this *ART* to be found who know how to make the same, and although much pains may be taken to instruct a *Potter* (in case of *Necessity*) how to make some *Instruments* belonging to this *ART*, yet it often happens that they do not make them well, nor in good shapes; whereby an *Assayer* may perform his *Work*: and therefore I (as well as others, when we could not have good *Instruments* made fitting for us) have been forc'd to make them our selves, which are done thus.

2.  
Of prepar-  
ing Loam  
for Instru-  
ments.

Take good *Potters-Loam* (as good as may be had) but the *Loam* or *Clay* that is blew and becomes white in the fire, is found to be the best for use; Let such  
Loam

Loam dry in the Sun till it be hard, and when you do intend to make *Instruments* of it, let it be well *pulverized*, then moisten it with *Water* till it become soft, and let it be well troden or broken with an *Iron*, then put among it the *Washings* of *Pibble-stones* or very fine *sand*, as much as the *Clay* can well bear, but that you may not add too much or too little, be sure to make out of such stuff some *Assay-Tests* or *Crucibles*, and put into them some *hard-flowing Oar* and place them in the fire, which will offer thee a *Tryal*, whereby thou maist see, if the stuff will hold, well, sound and firm; some do mingle among it some *Chalk-stone*, or the subtile red *Talk* or *Glimmer* in such place where there is much of it, but which is most necessary, *Experience* will teach: some take in stead of it the broken *Pots* or *Crucibles*, beaten small and sifted through a fine *Seeve*, and put so much among the *Clay* that they may vwork it vwell, because of its britleness, such *Crucibles* and *Tests* as are made of it hold vwell, (but vwhen *Pibble-stones*, as hath been said before, are mingled vwith it, that it doth bind together in the fire, and the bigger the heat is, the more doth it bind) and this *Proof-Test* may be taken vwhole out of the *Frame*.

When the *Loam* is prepared you must then have a *Frame*, in vvhich you may beat the *Proof-Test* and *Crucibles*: the *Frames* are best made of *Brass*, but they that cannot have such may cause them to be made of good *Wood* of *Pear-tree*, and an *Iron-ring* may be put upon it, very closely, that the *Frame*, by reason of much use may not split or break: then anoint the *Frame* vwith a little *Bacon*, and put in it a little *Ball* of the prepared stuff, as much as may be enough, and grease also the upper part of the *Frame*, vvhich is called the *Monk*, and beat the upper part vwith a vvooden *Mallet* into the *Case* or *Frame*, then is the *Test* formed,

Section.

3.  
How the  
Cases and  
Frames and  
Assay-Tests  
are made.

CHAP. med; press it out vwith your Fingers, but have a care  
 IV. that the *Clay* be not too moist, otherwise you can not  
 press the *Assay-Test* whole out: Some do put the *Case*  
 with the *Test* upon a suddain and quick heat, and so  
 the *Test* will come out whole, this is a very good way  
 to make the small *Crucibles*, but with the great *Assay-*  
*Tests*, it would be too long and tedious.

Section.  
 4.  
 To make  
 Muffles of  
 Clay over  
 wooden-  
 sticks or  
 Frames.

To make *Muffles* you must have wooden *sticks* cut  
 in form of that bigness the *Muffles* must be, grease them  
 with *Bacon*, and frame a Lump of *Lute* or *Clay*, of a  
 convenient bigness, that it may be cut with a copper  
 wyer, into a thin leaf or piece, and put it over the sticks  
 or frame, and cut out of it such another leaf, as may  
 make it a half round piece, that you may close it behind,  
 all this must be done upon the form, and must with a  
 moist hand be stuck close to it: then let it stand, nigh  
 three hours, that the *Clay* may be a little hardned, then  
 cut the *Muffle* out, so as you will have it cut upon the  
 sides and behind; and let it stand yet a little longer, that  
 it may go easily from the *sticks*: Some do strew a lit-  
 tle fine *sand* or *ashes* upon the *Frame* after it is greased  
 with *Bacon*, that the *Muffle* may come easily from the  
*Frame*: But that many *Muffles* may be prepared to-  
 gether, therefore cause more than one of these *Frames*  
 to be made, that in the mean time while one doth dry  
 several more may be made.

5.  
 How the  
 bottom of  
 them are to  
 be fram'd.

But, to the bottom *Leafs* or pieces you must have  
*Frames* of *Wood*, in *Widness* as the bottom leafs are,  
 thick and broad; they must be prest full with the pre-  
 pared *Loam*, then they will dry quickly, and come out  
 easily; or cut out of a piece of *Clay*, a leaf with a small  
 wyer, so thick as you would have it, and shape it fur-  
 ther as is necessary.

6.  
 Of drying  
 and calci-  
 ning the  
 Loam for  
 Assaying.

These *Tests*, *Muffles*, *Bottoms*, *Leafs* and *Crucibles*  
 thus prepared, must be very well dried, and then in a  
 Kiln



*Kiln or Potters-Oven* well calcined, although the *Muffles* and *bottom Leaves* are also used raw and uncalcined in the *Assay-Oven*, but there must be a very gentle fire, and the fire in the *Assay-Oven*, must first be kindled from above, downwards, and so they will remain whole, otherwise they will all fly in pieces; and thus you are fully instructed how the *Potters-Clay* is to be made into *Instruments*, and if they be not good and firm they are a great hindrance to the *Assayer*: the Forms of vvhich are truly to be seen in the following *Sculpture*.

CHAP.  
IV.

Sculpture IV.



Deciphered.

1. *The Muffles which the ancient Assayers did use, and the common Assayers do still.*

2. *The Muffle to the Noringberg Assay-Oven.*

F

3. *The*

- CHAP: 3. *The Muffle to the Assay-Oven with the two mouth'd*  
 IV. *holes.*
4. *Stopples.*
  5. *Bottom-Plates.*
  6. *Covers.*
  7. *Wooden Frames or Moulds for Muffles.*
  8. *The lower part of an Assay-Test.*
  9. *The upper part of an Assay Test.*
  10. *The Frames or Moulds for Assay-Tests.*
  11. *The lower part of the Assay-Crucible.*
  12. *The upper part to it.*
  13. *The Assay-Crucible perfected.*
  14. *The small Instruments for governing the fire made of Potters-Clay.*

## CHAP. V.

*Of Copels, and how they may be made firm  
and good.*

Section.  
I.  
*Copels of  
good stuff.*



It is necessary for a *Refiner* to have his *Copels* made well, because if the *Copels* be not made of good *Loam* or *Clay* they will devour the fine *Metal* very much, especially when the *Clar* is not well made which is to be put upon the *Copel*, because it will rise, and so the silver *Grain* will be hid under it, and if the *Clar* be not good, the silver *Grain* will be lost under the *Lead* and not fined. Also, if the *Ashes* be not good, or something fat or oily, then will the *Copels* melt in the *fire*, which will prove of ill *Consequence*, because with such there can be no *Tryall* made.

But

But, that you may have good *Copels*, that your *Try-* CHAP.  
*als* may be the better perform'd, make them in this fol- V.  
 lowing Manner.

Take *Ashes* burnt from any light *Wood*, (as *Sal-*  
*lows*, &c. for such are best for this use) and put them  
 into a *Seeve*, and pour *Water* on them that the *Ashes*  
 may be wash'd through the *Seeve* into a *Tub*, so the  
*Coals* and grosser parts may remain in the *Seeve*, then  
 pour into the *Tub* so much water more, that the *Ashes*  
 may be covered-over, then stir it about, and let it  
 stand an hour or two: whereby the water will draw  
 out the *fatness* and *oilyness* out of the *Ashes*, then pour  
 the remaining water very gently off, that the thick trou-  
 bled water may not go along with the clear water; and  
 then pour another water on it, and let it stand also  
 till the upper water grow clear; then pour it again gent-  
 ly off, and this do till the water hath no *fatness* or *sharp-*  
*ness*: then the third time pour clear water on the *Ashes*  
 and stir them about with a stick, as before, and pour  
 that water, whilst it is thick and muddy, into another  
*Tub*, that the gross part of the *Ashes* in the first may  
 remain till the water in the other *Tub* be clear and well  
 settled; then let the water run clear from it again, this is  
 the first clearing: then pour another water upon the  
 wash'd settled *Ashes*, and stir them again with a stick,  
 then pour the thick again into another *Tub* or *Bowl*,  
 that is to try if there remains any *Fatness* or *gross Ashes*,  
 that it may all be cleanly separated, and let the muddy  
 water settle very well because it is the last washing: and  
 when the *Ashes* are thus far prepared, then make *Balls*  
 thereof, let them dry well in the *Sun*, or in a *Bakers-O-*  
*ven*, and keep them clean for use.

There are some *Refiners* that in stead of *Ashes* <sup>3.</sup>  
 (burnt off light *Wood*) do take *Ashes* of *Vine-wood*, <sup>of Vine-</sup>  
 (but <sup>wood ashes</sup>  
<sup>and com-</sup>  
<sup>mon Ashes.</sup>

Section. 2.  
 Of Ashes  
 for Copils.

CHAP. (but they are not every-where to be had) and they do  
 V. wash and prepare them as abovesaid, some do use on-  
 ly such Ashes of which the common *Lixivium* or *Lye*  
 is made, but the two former are better, which you will  
 also finde by use and Experience, only there must be a  
 care that the Ashes be clear and well prepared.

Section.  
 4  
 Of Bone-  
 ashes, and  
 which Bones  
 are most  
 serviceable.

Munich.

Secondly, You must have to your *Copels* good  
 and clean *Bone-Ashes*, for which take *Bones* that have  
 no Marrow or Gravy, and burn them white, *pulve-*  
*rize*, and pass them through a hair *Seeve*, then grinde  
 them upon a stone, like Meal, and so you have *Bone-*  
*Ashes* prepared: then take two parts of the *wash'd A-*  
*shes* which have first pass through the hair *Seeve*, that  
 they may not remain in Lumps; and with one part of  
 the ground *Bone-Ashes*, and mingle these two well to-  
 gether, and moisten them with *strong-Beer* (but first let  
 the *Beer* boil away one third) or, with a *Glew-water*:  
 But, if you will bestow something more upon it, then  
 beat the whites of *Eggs* in water, and moisten the *A-*  
*shes* therewith, but not too much, that when you press  
 a handful together, the *Ash-ball* may well remain intire:  
 then let the *Copel-case* be well fill'd with Ashes and put  
 in, but be sure to scrape the superfluous Ashes off it,  
 and give the *Monk* three or four blows vvith a wooden  
 Mallet upon the *Copel-frame*, wipe the *Monk* clean off,  
 and strew (with a little wooden shovel) good *Clar* upon  
 the *Copel*, vvhile 'tis yet in the Case, and part the *Clar*  
 vvith your finger, and set the *Monk* strait upon it a-  
 gain, and give two or three Blouvs to fasten the *Clar*  
 upon the *Copel* (as necessity doth require) that the *Clar*  
 may be fixed upon it, then take the *Monk* off, press up-  
 on other *Ashes* the *Copel* out of the Case, so is the  
*Copel* ready; in such a manner may you make *Copels*  
 great and small, then let them dry till you have need  
 of them, so vvill they be firm and good.

Some

Some do use a special Instrument made of *Latten* CHAP. V. which is full of little holes at the bottom, in which they put the *Clar*, and with a wyer that hath underneath a little cross-*Plate*, they cause it to run through, but I do not like it so well, as if it were parted with the finger.

Section 5:  
An Instru-  
ment to  
strew the  
Clar.

Some do take also among the *Copel-Asbes* the tenth part of good *Potters-Loam* (which must also be wash'd like unto the *Copel-Asbes*) and dry it in the *Sun*, and this is necessary to be used with it, and when the *Clay* is good and holds well in the fire: otherwise it may do more hurt than good in the *Copels*, and I conclude, when a man hath good *Asbes* that are well washed (as I have hinted before) good *Copels* may be made that need no mixture, and those *Asbes* may well be moistned with fair water, but the *Copels* are more brickle by it, and not so firm, as with the *strong Beer* or *glew-water*.

6.  
Of Glem  
for Copels.

CHAP. VI.

How good Copels may be made, wherein the Tryals will not leap nor sparkle.



MUCH *Copels* as I have hitherto thought fit to mention, are good to be used, by vvhich the true quantity and proof may be found in them, vvhhen the Governance of the *Fire* is vvell observed, but if this be not minded, and the *Copel* be cool and hot, then some part of the *Silver* is soon lost, but if an *Assayer* is uncertain in the *Silver* and *Money-proofs*, and hath not a full knowledg of the *Fire*, it is better for him to cause the following *Copels* be made for *Tryals*.

Section.  
1.

Let *Knuckle-Bones*, or other *Bones* be burnt very  
G white

2.  
Bones for  
Copels.

CHAP. VI. white (the *Calves* or *Sheeps-bones* are best) among common *Bones*) stamp them fine, and grind them upon a *Grind Stone* fine as flower, then moisten such subtile bone-ashes (like other *Copel-Ashes*) with *strong Beer*, and of this make *Copels*, and strew *Clar* on them, as hath been done with the other before named *Copels*, and let them dry; so are they prepared.

Section.  
3.

But good and clean *Bones* of *Fishes* may be had, (which of all *Bone-Ashes* are the best to be used for *Copels*.) When you would assay upon these *Copels*, set them in the *Proof-Oven*, and when they are only *glowing* hot, then put what you do intend to try in them, and although they are only thus, the *Proofs* vwill not *leap*, but be purely finished: only this is to be noted, that the *Assayes* upon these *Copels* are much colder, longer and go more subtilly than upon the other *Copels*, therefore there cannot easily any thing of *Silver* be lost; and vwhen the proof is finished than may the *Grain* be taken off very pure and clean, and nothing stick to it, although it had been a *Coppery-Silver* that vvas refined in it, vvhich *Grains* do commonly enter into the *Clar*, and they cannot alvways be taken off cleanly from other *Copels*.

CHAP.

## CHAP. VII.

*How good Clar is to be made.*

**T** is necessary that good *Clar* must be had for the making of *Copells*, because if the same be not good, then there can be no good *Copells* made, although the *Ashes* be prepared as vvell as can be. Nowv (as for my part) I have vwith Diligence try'd many *Bones*, and have found that *Calves-head Bones* or the *Scales* that come from their Forehead are the best: Take them and wash them from a boiling hot water, or let them boil well in the water, that the *fatness* and *foulness* may be separated from the other, then dry them and burn them untill they be fair and white, then stamp and grind them on a stone, still moistning them with a little water, and put them in a *glaz'd Pot* with a *Cover luted* on it, and set them once more in a *fire* or *Potters-Oven*, and let them burn well for four hours, then let them cool; this done, take these *burnt Ashes* out of the *Pot*, and grind them once more very fine upon a smooth (or *Marble*) stone, that they may be very clear (of which clear preparation, the *Clar* hath its *Appellation* or name) keep it from *Dust*, and it will serve for your use at any time.

Section.  
I.

Some also do use *Harts-horn* to make *Clar*, and they burn it and order it as the other abovesaid, and this doth yield good *Clar*, but those of the *Scales* of *Calves-heads* I like better.

2.  
Clar of  
Harts horn

There is also of *Fish-bones* (as *Pike* and other *Fishes Bones*) very good *Clar* to be made, but the *Fatness*

3.  
Of Fish-  
bone.

CHAP. VII. nefs must be first separated from it, by boyling and burning them (as before) but this according to ones pleasure, and which *Clar* any one likes best, he may use, only he must be careful to see that they be finely ground to *Pouder*.

Section.  
How to be  
kept.

When the *Clar* is ground to *pouder*, then some do wash it in fair water, and make four-square *Pieces* of it, or *Balls* (like *Chalk-stone*) as I myself did some years since, but I find that if it be finely ground, and dryed only, it is the better, because by washing and drying it, and making them into *pieces* or *Balls*, they will grow hard, and cannot be so well scraped from the *Lumps*, as with that which is in *Pouder*.

Now, how the *Copel-Case* and the *Copel* is to be ordered and performed the following *Sculpture* will shew:

Sculpture V.



Deciphered.



Deciphered.

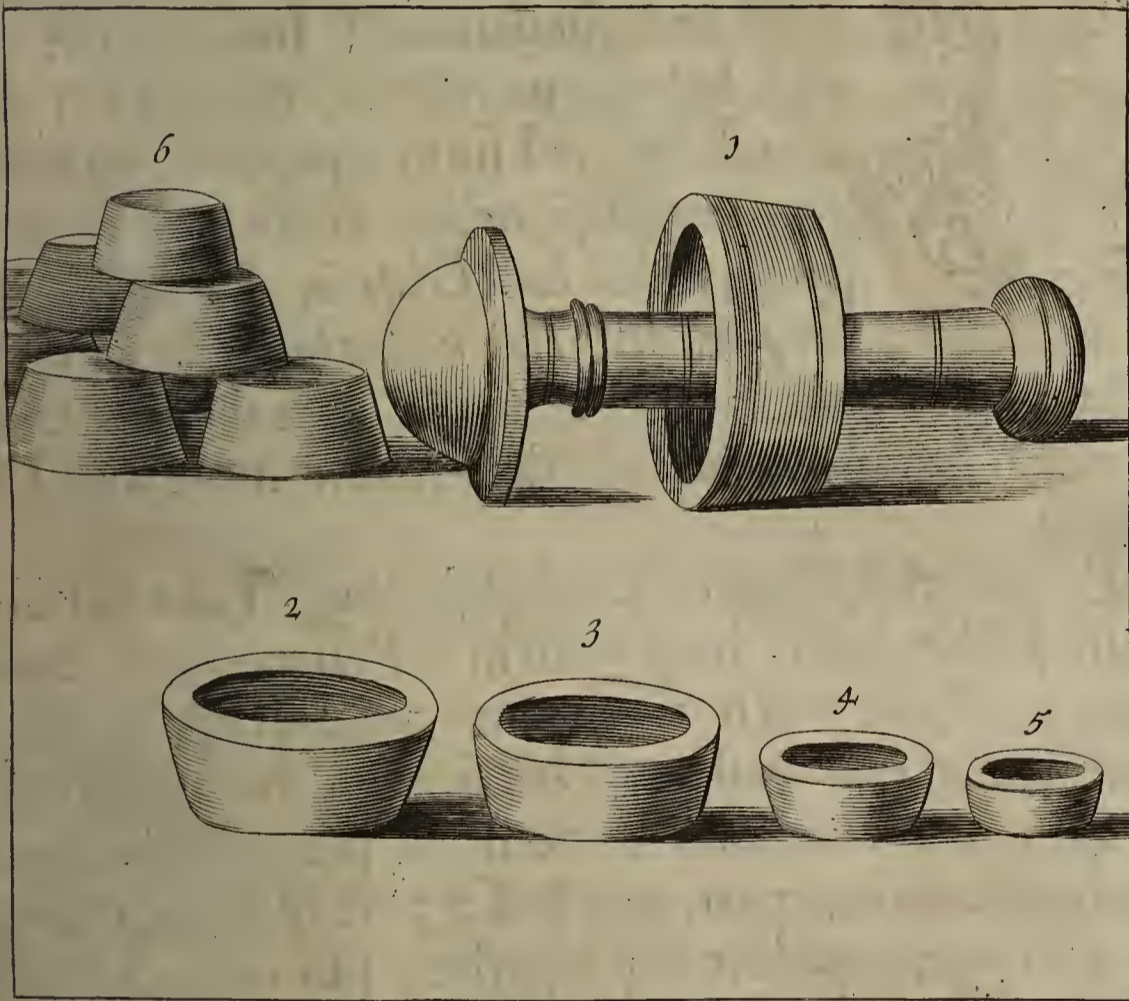
CHAP.  
VII.

1. 3. *The Copel-cases.*
2. 4. *The Copels that are made in them.*
5. *The Copels as they are set upon one another.*
6. *The Wash'd Ashes (or Clar) made into Balls.*
7. *He that works the Ashes.*
8. *He that strikes the Copels into their Frames or Cases:*

But that the Forms and Proportions of the *Copels* may the better be seen, the following *Sulpture* doth demonstrate.

Section.  
4.  
*Forms of Copels.*

Sculpture VI.



Deciphered.

1. *The Copel-Case.*
2. *The Copel for the Copper-Oars and common Proof of Common Oars.*
3. *The Copels for Oars that are poor in Silver, and also for common Oar Tryals.*

H

4. *The*

- CHAP. VIII. 4. *The Copel for common Siver-Tryals, which are assayed according to Weight.*  
 5. *The Copel to Starling-silver Proof.*  
 6. *How the Copels are set one upon the other in the Ovens.*

## CHAP. VIII.

*How Glas of Lead, or Lead-Glas is to be made.*

Section.  
1.

*Lead-glass  
to what  
Oars it is  
to be used.*



**S**URTHER, that every one may have good and fundamental Information of what belongs to *Assayes*, therefore I do intend, before I further proceed, to shew how the *Fluss*, or *lead Glass* must be prepared, which *lead Glass* is a *Fluss*, and is used to the very hardest and *unflowing Oars*, to the end that they may as easily be *boiled* up as the *soft Oars*: of which *boyling*, hereafter shall follow more full Direction.

2  
*To prepare  
Flus or lead-  
glas.*

Prepare this *Fluss* or *Lead-glass*, thus, Take fair and white *pibble-stones*, burn them in a *Potters-Oven*, stamp them small, and pass it through an hair *Seeve*, pour clean water on it, and wash the *Mud* from it, that the powder of the *pibble-stones* may be clean and pure: of these *pibble stones* take one part, and half a part of red *Littorage* or *Littarge*, mingle it dry together, put it into a *Crucible*, but not above two thirds full, and put *common Salt* on the top of it, or *Salt-peter* (if such can be had) about three Fingers height above the matter, and *lute* it well; and let it flow together with a strong heat in a *Wind-Oven* or *Tyle-Oven*; let the *Crucible* cool of it self, then open it, and all will be mingled in a *yellow Glass*; only a little *Regulus* of *Lead* at the Bottom, which is to be  
sepa-

separated, but preserve the *Glass*, which is the *Fluss*.

You may also melt the *Littarge* first by it self, and of the *slakes* that come from it, take ten parts to one part of prepared *pibble-stones*, and cover it with *Salt*, (as above) cause them to flow, and so a good *Lead-glass* will come of it.

Or take instead of the *wash'd Pibbles*, good wash'd *Loam*, which is dry and firmly *pulverized*, one part, and three parts of good *red Littarge*, cover it with *Salt*, let it flow in a strong heat, this doth yield a fair *Lead-glass*.

When the *Lead-glass* is made, and again melted in a *Crucible*, put a little *Niter* in it, and cause it to flow a while after, so the *Lead-glass* will become cleaner or more flowing: or one may use among it a fourth part of *Caput Mort.* and cause them to flow together, this also causes the *Fluss* to become finer and more flowing.

CHAP. IX.

Section. 3.  
Another way.

4.  
Another way.

5.  
To cleanse the Lead-glass.

CHAP. IX.

Of the Weights which belong to the proving of Silver-Oars.



THE *Centner-weight* by which all *Oars*, *Slicks* or *wash'd slake-stones* and what else of this nature are prov'd) is by the old *Assayers* proportioned thus: That the *Centner* is orderd to be just an Hundred pound weight: for this Reason, because in many places the *Oars* or *slake-stones*, and the *silvery unwash'd black Copper* is bought by weight, and the *fine Silver* in it according to the *Proof* (before it is melted out of it) is paid for this end, that the *Buyer* may not be a *Looser* ( because of the waste in melting

Section. 1.

CHAP. IX. ing to get out the *Silver*) therefore hath he so many pounds as the Common *Centner* of the *Mine* yields (or where it doth weigh more or above) which *Centner* of the *Mynt* doth commonly weigh an Hundred and ten pounds, so that he may have the ten Pounds that is above, with the *Silver* in it, to help to bear the loss) therefore in a well ordered melting of poor *Oars* they do hold most commonly 3, 4, or 5 *loth* of *Silver*, for the loss of the *Silver* in Melting should not be above the *Silver* contained in the ten Pounds of the *Oar*, that was over, comparing it with the proof-*Centner*: but in rich work and rich *Oars*, or concerning very rich *Copper*, the ten pounds which are above are also justly taken along with it.

Section.	17	} Dram.
2.	18	
Of dividing the common Proof Cent- ner.	2	Drams or half a Loth.
	1	} Loth or two Ounces.
	2	
	4	
	8	
	16	
	1	} A Pound.
	2	
	4	
	8	
	16	
	25	A quarter of a Centner.
	50	Half a Centner.
	100	A whole Centner.

3.  
Two sorts of  
Penny  
weights.

The *Peny-weights* are of two sorts, the one is with us in *High Germany*, the other is as 'tis used in *Holland*, after which the *Silver* or *Grains* may be tryed, upon a  
just

just proportion how much a *Mark* hath in it of fine *Silver*. CHAP. IX.

1) Heller, or Half-penny.

1) Pence.

1) Drams.

1) 2) 4) 8) Lotb, or, 4 half Ounces.

1) 6) Lotb is a *Mark*, or 256 pence.

1) 2) 3) 6) The single Grains.

1) 2) Grains is a Half penny.

1) 2) 3) Pence.

1) 2) Pence is a *Mark*, or 288 Grains.

There are so much as 256 pence.

Section  
4  
Of dividing  
the Penny-  
weight in  
High Ger-  
many.

5  
Of dividing  
the Low  
Dutch Penny  
Weight.

The *Mark* in the *Grain-weight*, is parted into *Loths* and *Grains*, like as the *Low Dutch Penny-weight* is parted into *Loths*, *Pence* and *Grains*, and this *Weight* is most commonly used for *Tryals* in the *Crucible* for *Coynd Mo-ny*, to which it doth best serve : for this Reason, because

I the

CHAP. X. the *Grains* here are reduced into greater Numbers, and the Contents more exactly found out, because in the *Peny-weight* it is only parted into *Pence*, and *Half-Pence*, and although the fourth part of a *Grain* (as to its Contents) is not usually reckoned, yet it is necessary for an *Assayer* to have such a fourth part in his parting or sharing for Information and Exactness sake,

$$\frac{1}{4}$$

$$\frac{1}{4}$$

$$\frac{1}{2}$$
 } *Single Grains.*

1

2

3

6

9 } *Grains is half a Lotb.*

1

2

4

8 } *Lotb, or two Ounces.*16 *Lotb is a Mark, or 288 Grains.*


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## CHAP. X.

*How all Silver-Oars are to be tryed.*

Section.  
I.  
*Assaying of  
soft flowing  
Oars.*



**S**HAVE mentioned before, That a difference is to be made among *Oars*, because some are *harsh*, *hard-flowing* and *raw*; as also that some are *soft-flowing* and *mild*: The *soft-flowing* *Oars* are thus to be tryed for *Silver*: Take the *Oar*, grind it with an *Hammer* upon a broad *Iron*,  
(fit-

(fitted to that purpose) as small as powder, weigh of it a Centner (with thy *Assay-weight*) put it on a well-made *Test*, and mingle eight times as much of *Lead in Grains* among it, and set in a warm *Assay-oven*, and presently make it hot, and set *Coles* before the *Ovens* mouth, so the *Lead* will begin to drive and turn quickly to *Slacke* or *Dross*, and when it hath stood so long in the *Proof-oven*, that the *Lead* upon the *Test* is all covered over with *dross*, then it hath *dross* enough; (this is called *Boyling up* or *Up-boyling*) then take an *Iron hook*, lay it that it may be a little red hot, and stir the *Oar* with it cleanly about, which is done for this *Reason*, that if there should stick any of the *Oar* on the sides of the *Test*, it may be made loose, and that the *Lead* also may work on it, and consume it: After the stirring, let it stand a while, and then take it out of the *Assay-oven*, and pour the *Lead* and *dross* upon an *Iron-plate*, in one of the little holes that are to be made upon the *Plate*, and let it cool, and then separate the *dross* clean from the *Lead*, so is the proof of the *Upboyling* ready, which is done in the space of about half an hour, afterwards set *Coppels* in the *Assay oven*, and let them glow well for half an hour, (and this is called *Nealing*) and upon these well *neal'd Coppels* put your *Lead* so wrought, which hath been *boiled up*, and make it warm that the same may first begin to work, and when it begins to drive, then keep the fire not too high, that the *Lead* or *work* may drive well, and go off upon the *Coppel* in a convenient heat, and so the *Lead* will all be drawn into the *Coppel*, and the *grain* of *Silver* will remain alone, (provided that the *Oar* hath *Silver* in it) upon the *Coppel*, although it be very small, then take the *Coppel* out of the *Assay-oven*, and take with your *Pincers* the *Grain* from it, so is the proof finished: Now, how this *Grain* is to be weighed, with the *Assay-Scales*, it doth require a special diligence;

CHAP.

X.

Section.

I.

CHAP. gence ; and of this you shall be more exactly instructed  
 X. afterwards.

Section.  
 2.  
 Tryals of  
 harsh Oars.

You shall *Assay* these *harsh* and *hard flowing* Oars in this manner, Take the *Oar* ground small, and weigh of it a *Centner* with your *Assay-weight*, put it on a good *Test*, and add to it its due weight of *Lead*, to wit, *Fourteen Centners* : set it in an *Assay-oven*, and give it presently heat, that the *Lead* in the *Assay-Test* may begin to drive, as you have done with the *soft-flowing* Oars, and when the *Lead* begins to drive, then let it be cold again, which will be, when you do shut the lower *mouth-hole*, and do open the *upper*, then will the *Oar* rise, and come to be *roasted* upon the *Lead*; when it is roasted enough upon the *Lead* (that is when it is seen to leave *smoaking* much and begins to *slacke*) then maist thou give it heat again, as much as can be. This happens when you do lay *Coals* before the upper *Mouth-hole* of the *Assay-oven*, so the great heat will force it, that the *Oar* will turn to *slackes*, but it doth *slacke* small and not easily, and when the *Oar* is almost *boyled up*, and hath *slacked finely*, then stir it cleanly with an *Iron-hook*, let it stand again a pretty while in the *oven*, and when all is turn'd to fine *slakes*, then pour it as before upon a *Plate* hollowed, or let it cool in the *Test*, and beat the *slackes* from it, so is the proof of *up-boyling* ready.

3.  
 A quick up-  
 boyling of  
 Silver Oars

In such manner, almost, may all *Pibbles* or *raw Oar* be *boyled up*, and this is a right and good way to do it, but the *up-boyling* is hardly done in an hour, yet it may be done sooner in this manner ; when you have weighed your *Oar*, and set it on the *Test* without *Lead* in the *Assay-oven*, give first some heat until the *Oar* upon the *Test* is *roasted*, and *smoak* no more : then set the *Lead*, (as much as belongs to the *Tryal*) upon the *Test*; give it a great heat, so will the *Oar* *boyl up* something easier, and in less time than if it should have been roasted upon the *Lead*. Al-



Although there are some that believe such a Tryal in which the Oar also is *roasted* without *Lead*) is false and not right, yet I do give this Information, That I have oftentimes, (with one sort or other) tryed both wayes, and I do truly affirm, That I have found no difference: But there must be a Care taken, that when the Oar is set alone upon the *Test*, that it may not be put into a violent suddain heat, because such an heat doth raise the small Oar, and doth cause it to dust away, especially when the Oars are *stony*, for it makes the Tryal false (this excepted) I know no fault, but be carefull and you will find it true.

CHAP.

X.

Section.

3.

Some have also another way to try *raw mild Oar*; as thus, They set first the *Test* in the *Oven*, that it may glow, and then put the *Lead* in it, and let it by it self *slack* pretty well, after that put upon the *slack'd Lead*, the *weighed Oar* in small Papers, so the hot *Lead*, and hot *Slack* will draw the Oar quickly to it self, and will not let it *rise* much, or *boil up* very well: this way I also like, only that in drawing the Oar upon the *hot Lead*, (especially the *mild Oars*) it will dust, and when there are many Proofs to be made together, there will something be neglected, and the Proofs may become false.

4.  
Another  
way to try  
raw Oars

If one doth know the Nature and Property of such Oars as will not easily boil or *slack*, but remain upon the *Lead* (for so will the *Chalk-stones*) the *gross* and *raw blind* or *Cobolt*, the *mispheckle*, as also the *mild* and *fresh Pibbles* and *water-pibbles* which must (as soon as they are weighed) be mingled with *Flus* or *Lead-glass* (as hath been before mentioned) which will hold the *raw Oar*, and doth not suffer it to rise high, because it hath help by the *Lead-glass*, so that it will become soft *Slacks* and *slacks* well, and boyls up clean, as may be seen in melting: *harsh Oars* (which in *Up-boiling* each one by his proper addition may be helped) that they will be well

5.

K

separa-

CHAP. separated, or else there vwill remain some *Silver* in the  
 X. slacks, and so there vwould be some *Dammage*.

Section. 6.  
 Of Assay-  
 ing the Cop-  
 per slacky  
 Oar.

In *S. Joakims Valley* (so called) there are *Oars* bro-  
 ken, vvhich are called *Coppery-Oars* or *flaky Oars*, vvhhen  
 they are once *boyled* up, the *Work* or *lead* vwill not go  
 off upon the *Coppel*, but casts up a *Ring* or *border*, and  
 eats much in, and makes the *Proof* false: and vvhhen this  
 is knowvn by an *Oar*, then must the vwork or *Lead*  
 vvhich hath been boyled up (and from vvhich the *dross*  
 is separated) be again set upon the *Test*, and be slack'd  
 again, and then the *Lead* vwill come off clean and *white*;  
 This is called, the *Lead cleansed* of its *Foulness*, then it  
 must go off upon the *Coppel*, as before.

7.  
 Cleansing of  
 the gross sul-  
 phury Flints  
 after Up-  
 boylng.

It happens also often, that the *gross Sulphury oars* do  
 also make the *Lead black* and *harsh*, also that upon a  
 well *neal'd Coppel* it doth not *drive*, but leap off, which  
 makes the *Tryals* oftentimes come false, because of its  
*Foulness*, such *Lead* you must once more set upon a new  
*Test* or upon the same, and let it slacke again, so will it  
 be white and clean and go well off upon the *Coppel*, and  
 loose nothing.

8.  
 To try Co-  
 bolt Oars.

Concerning the *Cobolt oars*, there are many sorts of  
 them, some *fresh* and some *milde*, *black* and *gray*; some  
 in trying do go easily into the *Lead*, but such *Lead*  
 that comes by *Up-boylng* from it, is *black* and *red*, and  
 it afterwards doth work upon the *Coppel*, and dissolves,  
 therefore it must after the first *Up-boylng*, be cleansed  
 again of its *Wildness* and must be slackd once more, so  
 it will become white, and go clean off from the *Coppel*:  
 One may also set the weightiest *Cobolt Oar* in a *Test* in  
 the *Oven*, and let the smoak pass away, some of which  
 sort do leave *gray Ashes*, and some a black grain upon  
 the *Test*, and the rest will burn all away, but put a lit-  
 tle *Lead* to it, and it will easily go in it, and also go  
 clean

clean off from the Coppel, and is found alike with the other Tryals.

But some do take it as above-mentioned, That when the *raw oar* upon the *Test* is *roasted* without *Lead*, the *roasting* doth take away some of the *Silver*, and that the *gross Sulphur* doth carry it away, and they will demonstrate it by some *volatile raw Flints*, and the *raw slackstone*, which comes from it; which after they are *roasted* do not yield so much *Silver* as if they were melted *raw* through the *Furnace*, to which I do yield, and have found the same true: But because the *roasting* generally in the *great Work* with quantities of *oars* is done in the *naked fire*, in which it also must lye several hours, contrariwise in the *Assay-oven* and *small Proofs* there is but little *oar* put in, and that in a close Fire is *roasted* in a short time, I judg for certain, that through such *roasting* of the *Oars* in the *Assay oven*, nothing can be lost of the *Silver*.

Some may ask, If this way of *using, trying* and *boyling up* of *Oars* in the *Test* (and to let them so go off in the *Test*) be the right way, or no, by which the true worth, and how much *Silver* the *Oar* contains in it may be known? To which I answer, That this is the right proving, after which the *melting Works* may be ordered, and set up: But the true worth, how much *Silver* the *Oar* hath in it, is not found there.

But to know this, Set a great Coppel (as is used to *Copper Assayes* for *silver*) in the *Assay-oven*, and *neal* it well, and put sixteen *Centners* of *Lead* in it, let it begin to drive, then put one *Centner* of the *ground-oar*, which must be parted into many parts, and put it in small *Papers*, one after another, when the one part doth come first on it, it will seem *stubborn* upon the *Lead*, and vwill cover it all over, but let not this hinder thee; Do it first a little cool, and then hot, so it vwill soon *slack* in the  
Coppel;

CHAP.

X.

Section.

9.  
Roasting  
Oar in the  
Ovens.10.  
Probation  
by which the  
right and  
full worth  
may be  
found.

CHAP. *Coppel*, and the *slacks* vvill pass avvay, then set an other  
 X. part of the *Oar* on the *Lead*, and that vvill do like the  
 Section. first, vvhich *slacks* vvill soon pass avvay, then put in  
 10. like manner the *Oar* all singly upon the *Lead*, and it  
 vvill all pass clean avvay in the *Coppel*, so that it vvill  
 hardly be discerned, but seem like any other vvork  
 upon the *Coppel*.

In this manner may all other Works (if they be *flow-*  
*ing* or *harsh*, as also melted *slack stone* and *Copper stone*)  
 be tryed through; in vvhich you vvill finde a great  
 difference, if you try the other usual Way of *Refining*,  
 but this vvay cannot be used generally, except of all  
*Oars* that are *melted*, to *slacks* vvhich are not altogether  
 without *Silver*; therefore the common way of *Assaying*  
 (with the *Up-boiling* upon *Tests*, of vvhich all *slacks* do  
 come, vvhich cannot be wholly without *Silver*) is the  
 best way: I have only mentioned these *Assayes*, to demon-  
 strate, That with the same (out of every *Oar*) the right  
 and full worth of *Silver* may be found in it, as fully as  
 in the other Common *Assayes*: For several years, some  
 vvorthy *Assayers* have weighed the *Oars* with the *Cent-*  
*ner-weight*, vvhich they intended to try upon *silver Proofs*  
 mingled with *Lead-glass*, and covered with *Salt* in a  
*Crucible*, and placed it before the *Bellows*, and did melt  
 it into a *Regulus*, after vvhich when the *Crucible* vvvas  
 cold, then have they beaten out the *Regulus*, and toge-  
 ther vvith the *slacks* have set it again upon a *Test* in  
 an *Assay-Oven*, and caused it to *slack* fully, vvhich vvay  
 is nothing vvorth, especially vvhen many *Oar-Proofs*  
 are to be made: then *Refiners* have soon seen it, and have  
 thereupon ordered their *Tryals* according to our vvay.

11.  
 To try with  
 Lead glass.

12.  
 When many  
 Oars are to  
 be tryed.

Here I must mention also, That vvhen an *Assayer*  
 hath dayly much to try (to vvhose hands vvithout  
 Question *harsh* and *hard-flowing* *Oars* come often) and  
 if he be then vvell skill'd he knoweth by much and dai-  
 ly

ly Experience and Practice) how each Oar is in the *Tryal*; therefore when he hath prepared the Oar for *Assaying* (and so he must because of the many sorts) use a bigger *Assay-oven*, that he may set several Proofs together at Work, whereby his *Tryals* may be made the sooner, and must keep this Order, when he will set his *Assays* in the Oven, if they be 8, 9, or more, he must place them accordingly upon the *Assayes*, which are prepared in this manner; *viz.* That always the *hard-flowing* Oars may be hindmost in the Oven, and that the *soft-flowing* may stand before: for they are soonest *boiled up*, and so may be taken out of the Oven without hindrance to those that must be longest in the fire, and then be cast upon an *Iron-plate*, vvhich Plate must be made thus, It must have as many Holes and Vents as there are *Tests* to be set in the *oven* at once: so that each Oar may be poured out from its *ovvn hole*, that you may not mistake: But if it should happen that (because of thy many *Tryals*) you must have above one *Furnace*, then put all the *hard-flowing* Oars into one *Furnace*, and the *soft-flowing* into the other; othervvise you must stay one *Tryal* for the other, which would be an hinderance. This vvay of *Assaying* is at *Kuttingburgh* (because of the great Oar-Trade in common use there) so that in some places every *Week* 200 *Tryals* of Oars are made, and the Contents are delivered to a *Dram*.

Section  
13.  
To assay to  
a *Dram*.

Take Notice, That it is vvith this, as vvith other *Tryals*, (as was before mentioned) only have a Care that you make use of an *Assay-weight* which may not be too little, and to have good and quick Scales upon which you may know the weight to a *dram*, or the fourth part of an Ounce, so then if you do well with the *Proof* in the Fire, then may you safely and surely give in the true Contents of as many *Loths* and *Drams* as you do find, after that one is weighed.

L

Further

CHAP.

X.

Section. 14.  
How to  
weigh the  
tryd grain.

Further, take Notice, That when thy *Tryal* is made and that you will draw up or weigh your small *proof-grains*, let your Scales be kept in a *Case of Glass* (that the same may be preserv'd from the Wind and Dust) then put into the one *Scale* the small *grain* of *Silver*, and into the other the *grain* of *Lead* (as small as it is) and put as much of the *Assay-weight* to it, that it may stand even with the *grain* in the other *Scale*, when this is done, then change the *Scales* that are in the *Proof-scales*, and see if the *Scales* stand even as before, if then the *Proof* be found alike on the one side as on the other, and just with the weight, then may the same be judged true, and be given in.

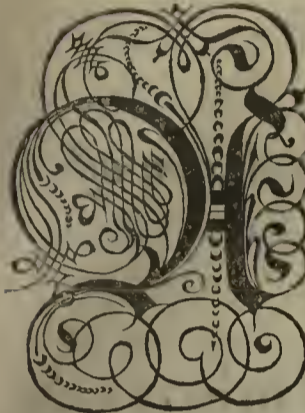
15.  
To boilrich  
Oar with  
Fluß.

Such *silver Oars* as are very rich may also with the *Fluß* (made of *Salt-petar* and *Argol* as shall follow hereafter) be mingled and put into a *Crucible* and covered over with *Salt*, and may be melted like unto the *Copper Oars* before the *Bellows*, and there will be a *silver Regulus*, in the bottom of the *Crucible* (which is not very *tuff* nor pure, because of other incorporated *Metals*) the which you may make fully *tuff* upon a *Test*, and in this manner the *silver* is very easily to be had out, but it is not the true *Contents*, because the *Slacks* do yet contain part of the *Silver* in them, the *grain* also doth not come very fine from the *Test* except it be done upon the *Coppel*.

CHAP.

## CHAP. XI.


CHAP.  
XI.*How poor Oars of Silver are to be Assayed.*

 S for *poor* and unclean *silver Oars* which are mingled with stones (and yet may be wash'd off with water) *Assay* them thus; stamp and grind them in an *Iron Morter* very fine (like flower) mingle all well together; and weigh 28 *Centners* of it with the *Assay weights*, then put it into a smooth *Tub*, wash it with water till it remain like a fine *slick* or *Clay*, then weigh this wet *slick* and you will find how much those *Oars* do weigh and afford of clean *slick*, in one *Center* (because the *slicks* that are made clean by washing are also weighed vvet) try it upon *silver* (as you have been taught above) after such a *Proof* you may make your *Accounts*: and if by preparing and vworking thus you can subsist: such a *Proof* hath preserved many an *Assayer* from danger of loss.

Section:  
1.

## CHAP. XII.

*To try Muddy-vvater springs of Silver.*

 OMETIMES it comes to pass that from *mild silver Veins*, there springs out of the *Mountain* a blackish or yellowish *muddy water*, which doth often contain *Silver*: this you must try thus, Take a *Potfull* of *this Water*, boil it that there may

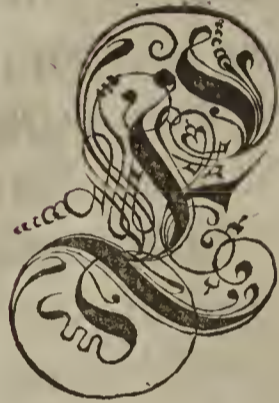
Section:  
1.

CHAP. XIII. may remain a *slime* or *settlement*, weigh this, and do with it as with other *Silver Oar*, so will you finde what it contains.

### CHAP. XIII.

*How a true Lead-Grain which is usually drawn off in the Proof, is to be made.*

Section.  
I.



VERY Assayer hath need to have great Care of the *Lead-grain* which he may make of the *Lead* that he uses dayly more than one *grain*, that he may be certain, because all *Lead*, almost, doth contain *Silver*, and although the *Lead* of *Villach* is counted the best for to assay withall, yet there is but little to be found of it that is quite without *Silver*.

2.  
The Lead of  
Villach not  
without Sil-  
ver.

So then there is no grounding upon this, because unexpert *Assayers* that do run off upon the *Coppel* four *Centners* of *Lead*, and vwhen they find no *Silver* therein, do therefore conclude that there is no *Silver* in the *Lead*, but there is need to run off so much *Lead* upon the *Coppel*, as much as is required to every *Assay*, and to try it more than once, and if then there is found nothing in all this, then may it be concluded, That the *Lead* holds no *Silver*, and yet one is not to rely altogether upon it, but an *Assayer* is to prove his *Lead* several times over and over, again: that if a piece or lump should differ one from another (because the *Pieces* of *Lead* are not all cast at once in the *smelting House* where it is made) that he may be certain of his *Lead*, which is of much concernment: and so you will finde that also the  
Vil-



*Villach-Lead* doth leave a grain of *Silver* when the full weight of *Lead* is *assayed*, which *silver-grain* is to be laid upon the *Scales* with the *Assay-weight*, that it may be abated from the other *Grain* of *Silver* which came from the *Proof-Oar*.

CHAP.  
XIV.

Further some *Assayers* are of the mind, That if there is a little *Copper* added that holds no *silver* at all, and doth cause it to go off on the *Coppel*, that then the *Lead-grain* is found the better: this is well, if one desires to try *Copper* upon *Silver*, and so to make the *Lead-grain*; but to *Oar-proofs*, and to other things which are not *Coppery* such a *Lead-grain* must not be used.

Section.  
3.  
The Lead-grain with the Addition of Copper.

Because all *Oar-Tryals* do *slack* in the proving such as are very rich of *Lead*, and yet do afford some *Silver*: the Opinion of some is, to take the weight of *Lead*, and a *Centner* of *Earth* of the *Mine* or common *Oar* which hath little or no *silver*, and boyl them up together; that they may turn to *slacks*, as is done with the *Oar-Tryals*; then the *slacks* will draw in part of the *Lead grain*, which is to be counted for a true *Lead-grain* for use. But I judge because the *Lead grain* is otherwise poor, that the *Difference* herein is not great, yet it is left to every ones pleasure to make use of his own way.

4.  
To make another Lead grain.

CHAP. XIV.

How a *Slackstone* or *Copper-stone* is to be made, and to be tryed for *Silver*, and what the *Slackstone* is.



**S**LACKSTONES (as the *Philosophers* do judg) are *Sulphur* and *Arsnick* mingled vwith a subtil *Earth*, and doth separate in *fusion* from the *Dross*, and doth draw the *Copper* and *silver* to it self, demonstrated thus; The *Brimstone* in the

i.  
What Slackstone is.

M

be-

CHAP. beginning doth roast away, and the *Arsnick* doth sub-  
 XIV. *lime* it self with a strong heat, but the Earth in which  
 the Silver is and the Copper doth remain, which is after-  
 wards easily brought to *slacks*, that the Metal may be  
 separated, which otherwise could not be if the *Arsnick*  
 had been with it, from hence may be known how to  
 draw the *Silver* and *Copper* out of the *Slackstone*, so can  
 it be no otherwise than to separate the *Sulphur* and  
*Arsnick* first from it, which is done by roasting,  
 as may be seen in the great works of *Smelting*;  
 thus, that the *Slackstone* in the beginning may have  
 but small heat ( and not a strong fire ) so that the  
 cold Air may easily fall upon it, and cause the veno-  
 mous *Sulphur* to rise, ( which doth fly from cold; and  
 loves the heat ) and so doth easily separate, which other-  
 wise doth stay in a violent heat, and remains alwayes  
*Slackstone*, and is afterwards not so easily separated, yet  
 a small heat only doth it not, therefore in *roasting*,  
 the fire must be increased by degrees, and in the End,  
 when the *Sulphur* is almost roasted away from the  
*Slackstone*, then with a strong fire the remaining *Sul-*  
*phur* and *Arsnick* must be driven away, although  
 the roast should flow with it, yet it is no hurt to it: I  
 do write this, That it may be seen, that the *Searchers*  
 of *Nature*, have also with Diligence searched into  
 these things, and that *Roasting* hath had its rise from  
 thence.

<sup>2.</sup>  
 To separate  
 it from Sul-  
 phur.



<sup>3.</sup>  
 Which way  
 the Cakes  
 are to be  
 knock'd out.



When the *Red Slacks* or *Copper-stones* are prepared  
 and the *Cakes* set upon one another, and you are wil-  
 ling to try them for *Silver*, then beat out of every  
*Cake* a piece, not quite in the middle nor quite at the  
 end, which is the best for proof (because the *Silver*  
 runs toward the Cold) so that the *stone-Cakes* are found  
 richer at the end than in the midst: ) Take all the pie-  
 ces that are cut out, mingle them together, and make a  
 proof

proof of it (this is called *Younger proof*) which you may grind very small, and weigh of it a *Centner* with thy *Assay-weight*, and assay such a *Stone* (as you have been taught above) and as hath been done with the *harsh Oars*, put presently its due of *Lead* to it, and let it first *roast* off upon the same. In the end give it good heat, that the proof may be boyled up; But because this Proof is of much *Concernment*, therefore take sixteen weight of *Lead*, that the *Tryal* may have enough, because for a *Tryal* it is better to have the weights of *Lead* too much than too little.

CHAP.  
XV.

CHAP. XV.

To try *Hard Work* and *Copper - Laech* upon  
Silver.

**S**RY and fat *hard Work* or *Copper Laech* some Founders (especially them of *Cuttenberg*) do use for an Addition to work the *silvery Oars* into flacks, that such Addition may be rich in *Copper*, and that *fresh Cakes* may be cast, and the *Silver* separated, to which in Comparison to common *Refining*, there belongs a particular Account and Understanding, for such dry and fat *Hard Work* must be tryed for *silver*, like unto a *Leadish black Copper* (which is almost one thing) and of which there will soon follow Direction.

Section:

I.

Two Sorts  
of *Hard  
Work*.

CHAP.

CHAP.  
XVI.

## CHAP. XVI.

To Assay melted Speiz, and what it is.

Section.  
I.  
What Speiz  
is.



2.  
To take the  
Silver out  
of Speize.

THE Speiz Oar is in many places (especially in *Joakim's Valley*) and is found out in melting: the Philosophers do think that it consists of *Arsnick* and *Brimstone* mingled with a subtil Earth, vvhich doth separate it self from the *slacks*, like unto the *Copper slack stones*, only in the *Speiz Oar* and the *slack stone* there is this Difference: For, as the *Brimstone* doth surpals (as abovesaid) the *Arsnick*, so in the *Speizy Oar* the *Arsnick* surpasseth the *Brimstone*: therefore the *Speiz* is vvhiter than the *Slackstone*, and doth loose but little either in the strong, or small fire, nor by roasting; nor can it be overcome by *Lead*, but is always found again, and doth loose but little; only this is necessary to be known, that when the *Speize* is melted in the *flintish-Lead Oar* gently, and not over-heated, and doth then mingle with the *slacks* of *Iron* and (according to the manner of the *City of Goslar*) doth melt among the light *Dust*, so comes the *Speiz* to be lost, and none of it is found again, and the *Silver* enters into the *Lead*, which is caused by the *Antimony* in the *Lead-oar*, and the *red Sulphur* in the *Flints*: which are both again in the *Arsnick*. But when there is a desire to *Assay* the *Speiz* for *Silver*, you must grind it small, and weigh it, and with so much *Lead* (as a *slackstone* hath need of) set it on a *Test* in an *Assay oven*, and in the beginning a great *Grain* of *speiz* vvhill be found swimming upon the *Lead*, vvhich cannot be consumed by

by it, some Refiners do take this Grain with Pincers CHAP. out of the Lead, and although the silver of the speiz XVII doth enter into the Lead, yet without question such Grain doth contain some silver: But that the full Contents thereof may be found out, Leave the Grain on the Test, and add to the speiz on the Test, some filings of Iron, that hath no silver, and then the speiz will be quite consumed, and become dross or slacks.

CHAP. XVII.

How Black Copper is to be melted and cast into Ingots.



HERE are many sorts of Black Copper, one part is very good, but others unclean and harsh, as Iron-slacky, leadish, speizy, and also sometimes tinny, according as a Copper Oar doth break by another metallick Oar, or, if any of them hath veins through the Copper Oars, such a Metal comes to be mingled with the Copper, and is the worse for it.

Section. 1.  
Difference of the Black Coppers.

So then, if you will cut out such black Copper and will cast an Ingot of it, Take of the Cakes which have been made upon the roast at once into Copper, cut a small piece of every Cake above and under, and not quite in the middle, nor at the end, according to proportion and bigness of the Cake; and here you must be careful that you do not cut a small piece out of a great Cake, nor a great piece out of a small Cake, because one Cake contains more silver than the other, and so a Proof may be soon made false.

2.  
How black Copper is to be cut out.

When the Cakes are all cut out, then put all the pieces

N

3.  
How the Proof-Ingot is to be cast.

CHAP. ces into a *Crucible*, melt them before the Bellows together, and when the *Copper* begins to flow and drive, then  
 XVII stir it about with a dry splinter or stick, and let it stand a little longer, then take a clean *Ingot* rub'd with a little tallow, and cast the *Copper* into it, all at once, that nothing remain in the *Crucible*, but set the *Ingot* smooth, that the *Copper* may be no thicker at one end than the other, because where the *Ingot* doth hang, the *Copper* runs that way, and is richer there in *silver*, especially in rich *Copper*. You must also quench in water the cast *Ingot*, if the *Copper* hath not been *leady* or *tinny*, and with a hard *Charcoal* the tallow may be scoured off, and the *Ingot* cleansed, but the *Lead* and *Coppery* cast *Ingot* must be left cooling in the *Ingot*, that the *Lead* may not rise up, so is the *Ingot* finished, which is to be cut half-through the *Ingot*, and beat it cross vway, then vwith a *Hammer* and *Chisel* strike it into two, so in the breadth the goodness of the *Copper* may be seen, and how the *Ingot* hath been together: and one half is to be given to the Buyer, and the other to the Seller, that if there should be an Error in the Proof then the *Ingot* might be assayed again.

Section.  
 4.  
 Difference  
 of the Proof  
 Ingot.

It is also necessary to know, that if the *Copper* doth drive too long in the *Crucible*, it doth waste and become richer in the Contents, which is easily to be seen, besides, if the *Ingot* be cast too hot, it will be in some places full of little holes, also if it is not all over smooth, but wrinkly and with knots, then it is cast too cold, so it is not found alike in Contents: if any of this happens in *Casting* by negligence, then such an *Ingot* is to be done away, and the *Copper Cakes* again cut out, to cast another *Ingot*, and thereby you will fine the right proof, and contents; because if the first should be melted and cast again, then it must drive again in the *Crucible*, and the

the *Copper* would waste more, so the Contents would be richer, and the *Tryal* false.

If you intend to assay such, *Cast Copper Ingots* for *silver*: Cut (with a *Chissel*) at the end of the *Ingot* a little piece, put that away and cut another, beat it flat upon a clean *Anvil*, or, if tis brittle, then to small bits, which you may weigh and assay thus: weigh of such pieces equally two *Centners*, put each in a small paper by it self, make it so that it may lye flat in the papers; and not in heaps, put also two great well-made and well neal'd *Coppels* in the *Assay-oven*, in the middle under the *Muffle*, and in each sixteen *Centners* of good *clean Lead*: but before all this, make a flame in the *Oven* with a *Copper pipe*, and the *Oven* and *Coppel* must be clean that no *Ashes* may remain in it, make it at the beginning warm, and when it begins to glow, and when the *Lead* doth go upon the *Coppel*, and doth not leap; then put the weighed *Copper* upon it; make it hot again untill it begins to melt or to go *fresh*. After this open the upper *Mouth-hole*, and shut the lower, cover the *Oven* with a *Cover*, yet not quite close, but that it may remain open about an inch wide, or as necessity doth require; Afterwards set behind (and upon the sides of the *Muffle*) the little Instruments, so the *Copper* will soon begin to go, then let it have a requisite *Coldness* (because the *Copper* among other Metals (try'd for *silver*) can endure the most cold. And after it hath gone a while cold, then lay before the upper *Mouth-hole* a few live coals that do not sparkle, or, if you do make your tryal in the *Furnace* made of *Armour-plate*, as in *Sculpture III. Figure 9.* then put before the upper *Ovens-mouth* the little plate full of holes, and govern the fire with such live *Coals* on the plate with holes, or by moving the *Cover* above, that the tryal may be hotter and hotter untill the end, then take the *Cover* quite

CHAP.  
XVII

Section.  
5.  
Assaying  
the Ingot.



CHAP. XVII  
 Section. 6.  
 The Regiment of the fire.

quite from the *Oven*, and cause the *Grain of Silver* to be all over bright and clean from spots, because the *Copper Assay* and government of the fire is of much concernment, and is accounted so, because it is necessary to know how to give heat and cold (as it requires) if the same be duly perform'd) but if it is not so, and that the tryal be too hot, then there will be an ounce of *Silver* less in a *Centner* of rich *Copper*, and the Contents will be found so much poorer, but because such a *Knowledg* and *Government* of the fire cannot be described, but is learned only out of much Experience, therefore do I rest here: But yet know thus much, that if the Proof on the *Coppel* doth grow high and clear, then it is hot, but if it doth go flat and darkish, then doth it go cold;

¶ There must in the *Copper Assay* in all Tryals, the middle way is to be observ'd, and the true contents will be found: although young *Assayers* do much esteem their own Works, and do slight knowledg of the fire, yet it is certain, as the *Copper* for *silver* by such means is right *assayed*, so must it be done with all other *Copper Tryals*, and he that is well acquainted with such *Copper* proof in the fire, he will want nothing in other Tryals, as hath been said.

7.  
 Of the Grain produced from the Assay.

Thus, when the Grains of such two tryals have *twinkled*, fresh and clean, then take the *Coppel* out of the *Oven*, and take the *Grains* off, while the *Coppel* is yet hot, so they will part clean from the clear, and the *Coppels* which bring the yellow subtil *Littarge* alwayes vvith it. Provided it hath had its due *Heats* and *Colds* (as hath been said before) but if it hath had too great heats then there vvill be no *Littarge* and it is not good to trust to such Tryals, but vvhen the two *Assay Grains* in the drawing up of the *Scales* are of a like vveight, then is it a sign that the proof hath been well made, but if they differ, although the Tryals have been diligently per-



performed, yet there is no certainty to ground upon it, and it is better that such be made anew; but forget not when you do intend to dravv up the Proof vvith thy vveight, to put it in the scales vvith thy vveight lead, grain of the Assay lead, and to beat it off from thy proof grains, although it be very small.

CHAP.  
XVII

One may as vvell lay the vveigh'd copper first upon the coppel, and let it glovv vvell, and aftervvards the due vveight of Lead, vvhich is as vvell; only the coppel must first be vvell vvarmed, othervvise the Lead will leap upon it, and the proof become false, which cannot be by the former way, because if the Lead which is set first alone upon the Coppel should leap, it may then quickly be made still again, if a live Coal be laid a little while on the top of it, and afterwards put the Copper upon it, so it will not hinder the Tryal.

Section.

8.

Another way to try Copper for Silver.

Further, every Assayer ought to know when the Coppels are not made of good Ashes and well prepared, for hereby they become tender, and will rob the proof of some Silver; likewise, when he doth use a new Assay-Oven, to which he is not used, and doth not know well the Degrees of fire in it, so it is better that he may learn first to know well the nature of his Coppel and Oven, that he may trust to it, and this may be done in the following manner: Take a Copper Ingot, of which a Centner contains about forty Loth, or twenty Ounces of Silver (which in many Tryals hath been found of a certain Content) and of this make one or two Tryals one after another, as often as you do intend to change your Instruments; then, if you finde the first contents, you are certain of your Instruments, and there is no fault in them.

9.

Proof Instruments

to have

great care of

Concerning the black-iron-streamy-slacky and raw Copper they are not to be assay'd like the abovenamed good Copper upon the Coppel, therefore when you do intend

10.

Proving of the black & raw Copper

CHAP. XVII to try such, beat them small and weigh of them two equal *Centners*, put each of them in a particular clean *Test*, place them in an *Assay-Oven*, and when they are glowing through, put to every *Tryal* its due proportion of *Lead*, to wit, sixteen *Centners* (like them before) and make them warm, and so they will begin to *slacke*, but you must not let them *slacke* too much, for then the *Lead* will enter into the *slacks*, and there vwill remain too little *Lead* with the *Copper*, and so cannot go clean off, but if the proofs be right boyld up, then take them out, and let them cool in the *Tests*; afterwards separate the *dross* from it, and cause the *Lead* or work to go off upon the *Coppel*, as cold as can be, yet so as that the proofs (as hath been taught before) may not congeal too soon, but appear pure and bright, and hereby you will have the true *Contents*, because such *unclean coppers* when they are not boyled up at first, but enter *raw* upon the *Coppel* into the *Lead*, then they do *slacke* upon the *Coppel* and fret on it, and the proofs must be hotter, so that the true contents cannot be exactly found out.

11.  
The weight  
of the Cop-  
pels.

Further also, I cannot leave unmentioned, That the *Coppels* after the proving of *Copper* do alwayes come heavier out of the fire, than they were set in at first; which thing although it brings little profit to a *Refiner* to know; yet it is to be vvondred, vvhat the cause of it might be.

CHAP.

CHAP. XVIII.

To try Bell-metal for Silver.



**S**ELL-metal, of old broken-Bells (vvhich is sometimes rich in Silver) must be tryed like unto the black raw Copper; but because of the Tin that is in it, it must be boyled up stronger, therefore there must be to such Tryals, four parts more of Lead than to Copper, by which also the Lead doth loose more: Or, weigh of such Bell-metal only half a Centner, and allow to it so much Lead, as to a Centner of Copper, so it will slack clean, and there will remain enough of Lead with it, (after it is boyl'd up) to drive off in the Coppel.

Section:  
I.  
Bell Metal.

CHAP. XIX.

How old Silver-plate or Coyn is to be made into Grains.



**S**RAINING of Silver is done for the most part when bad, broken or other forbidden Money (coyned in Hand) that the same may be all melted together and afterwards to Assay it, and to fit it for better coining, that also the bad Money may be rooted out of it: this is to be done thus; When there is much of it to be granulated, then must there first be a furnishing of necessary Instruments, viz. Crucibles and

I.  
For what  
theGraining  
of Silver is  
profitable.

CHAP. and *Wind-Ovens*, that one may easily *granulate* a great  
 XIX. quantity of *Silver* in *Plate* or *coin*, and when you have  
 all *Necessaries*, then set the *crucible* empty into the *wind-*  
*oven*, a good hand-breadth higher than the grate, and  
 cover it with an *Iron* cover, cover the *crucible* all over  
 with coals and ashes, and upon them live coals, let the  
 fire kindle from above downwards, then you need not  
 fear, that it will be crack'd (as it happens sometimes  
 when it is set in a suddain heat) and when the *crucible*  
 hath been set thus in the fire, and that the fire hath vvell  
 kindled downwards, so that the *crucible* is red hot all  
 over, then uncover it, and see if it is yet vvhole, and hath  
 no crack, vvhich is soon seen in the glowing heat, then  
 put in the *Silver* that hath been first vveighed in the *cruc-*  
*cible*, and cover it, put coals over it, and give it a strong  
 heat, that the *Silver* may sink, then may you put more  
*Silver*, if you have it into the *crucible*, and give it fire  
 again, that it may sink, and also followv it vwith the *Sil-*  
*ver*, until the *crucible* be full, vwhen that is done, then  
 give it fire enough, so long till the *Silver* in the *cruci-*  
*ble* begins to *drive*, and when thou seeft it *drive* then  
 throw upon the *Silver* (in the *Crucible*) coal-dust, or  
 Ashes that the *Silver* may be covered with it all over;  
 stirr it well about with a glowing hot *iron hook*, and af-  
 terwards with a small warm *Crucible* take the *Silver* out  
 of the greater *Crucible*, and pour it in cold vvater.

Section.  
 2.  
 Why the  
 Crucible so  
 easily breaks

3.  
 To granu-  
 late the Sil-  
 ver round.

\* *Waltzen*.

If you vvill have *round Grains*, then pour the *Silver*  
 through a vvet *Broom*, but if you vvill have your *Sil-*  
*ver hollow* and *thin* for separation then stir the vvater  
 vvith a stick vvell about and pour the silver into the  
 boyling vvater, so vvill it become hollowv and thin, or  
*granulate* it over a \**Role*, (vvhich being half in and half  
 out, the water vvill run about, so will it be *hollow*, after  
 it is *granulated*; then pour the water off from the *Grains*,  
 and dry them in a *Copper* bason over the fire.

But

But if there be many to be melted and *granulated*; CHAP.  
 the *Crucible* is to be set likewise into the *wind Oven*, and XIX.  
 first kindle the *fire* by degrees, that it grow warm, that Section.  
 you may see if the *Crucible* doth remain whole, because <sup>4.</sup>  
 if the same in the first kindling doth remain whole, it will *How to go-*  
 hold well in melting, provided the first be well tended, *vern the*  
 so that the *Crucible* may not stand naked, but that it *fire.*  
 may have a like heat, because the place that is left naked  
 the cold doth work upon it, and in that part doth easily  
 break, therefore it is necessary to put the coals sometimes  
 down about the *Crucible* with an iron Instrument, that  
 the *Crucible* may be preserv'd, and when the *Crucible* is  
 glowing warm and whole, then put with an iron Instru-  
 ment (which is made purposely for it) the old *Silver*  
 therein, that the *Crucible* may be heap'd full, and put  
 the cover upon it, and afterwards coals, and give it  
 convenient heat, and the *Silver* will easily sink down,  
 and still go on in putting in *Money* so long till the *Crucible*  
 be full with the melted stuff, and then give it a  
 strong fire or two, that it may be fully hot in the *Crucible*,  
 and when you see that it doth cast a *black Scum*  
 upon the *Crucible* (which *scum* you must take off with  
 a *Scummer* full of holes, and let it be cold) then sift it  
 through a fine *hair seeve*, that the *grains* of *Silver* which  
 have been taken (with the *scummer*) out of the *Crucible*  
 may be put to the other *Grains*; keeping the black  
 dust that falls through the *hair Seeve*, because there is  
 yet silver in it, which afterwards you may make to pro-  
 fit; when you have taken all the *scum* from the *Crucible*,  
 then cast again some clean coal-dust upon it, give it  
 fire once more, that it may be very warm, and drive it,  
 if it be not so, then the contents of the grains comes  
 not alike, and it happens sometimes, that that which is  
 not alike must be *granulated* again, which can not be  
 done without loss, therefore be carefull at the first, and

P

do

CHAP. XX. do not hasten too much with it, so when it is full hot in the *Crucible*, then may it in the same manner (as hath been taught above) be taken out of the *Crucible*, and be cast through a *wet Broom* (which hath not many small twigs) into the water, or, if there be much to be cast, then have two *Brooms* to cast through, that the one after the other may be dipt into the water, this is the common way of *granulating*, and it is the best vway to do it, by vvhich the *grains* have an equal content, and near finely *round*.

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## CHAP. XX.

To granulate out of a Kiln.

Section.  
I.  
The manner  
of perform-  
ing it.



URTHER, there is another way to *granulate* (now used) call'd *Granulating out of the Kiln*, and is thus: Cause a *Kiln* to be made of *Potters earth* (a little above a *Span* diameter within) which must have *Iron-hoops*, and the middle ring or hoop must have a long *Iron-handle*, and at the end of the handle a ring; likewise the *Kiln* is to be cut out on that side towards the *Bellows*, and when there is an Intention to *granulate* in the *Kiln*, then it must be set before the mouth of strong *Bellows*, and coals put in it, and after let the *Bellows* blow into it, that it may glow well; and then the old *Silver* (with an *Iron-ladle*) must be put on the top of the *Coals*, and the *Bellows* must blow always, so will it melt easily; and put still more *silver*, and let it flow: do this so long till as much *Silver* is in the *Kiln* as it can hold: stir it well about, after that, Take the *Kiln* vwith the coals in it, from the *Bellows*, and take it vwith the handle upon thy arm, and the ring which is at the end of the handle in thy hand, by which  
you

you may govern the *Kiln*, and so *granulate* it out of the *Kiln*; through *Brooms* as hath been said before. CHAP.  
XX.

This is a quick way to *granulate*, but the Contents of the old *Silver* is sometimes not found alike, and it doth also waite more than by other *grainings* or *granulations*: Now as often as there is need to melt in such a *Kiln*; it is necessary to do it alvvayes well over with a good *Clay*, that may hold well in the *fire*, otherwise, when the *Metal* is warm, it may flow through it.

Section.

2.

A quick  
way of gra-  
nulating.

It happens also often, that if a *Crucible* doth leak or or run out; and in that case sweep all clean together, put it in a *Vessel* and pour vvater on it, and that vvhich doth swim at top, take off, and throw away, and pour other water on it, this do so long untill the water doth go clear off, then out of the *Residue* pick out the course sand and stones, and stamp the rest in a *Morter* and *searse* it through a hair seeve, that which doth not pass keep it, because it is good, but that which goeth through, vvasht that again in a long *Tub* made of *Firr*, that the residue of the good may be got out: because where much is to be *granulated* there will be sometimes some *Mischance*, so that a *Crucible* may run out, and cannot be rectifi'd again without los and dammage. The following *Sculpture* is thus

3.

When the  
Crucible  
doth break.

Deciphered.

1. The Grain or granulating Kill or Kiln.
2. The Wind-Oven of Potters-stuff upon a Trevet or three-foot Frame.
3. Another Wind-Oven of Potters-Loam with Iron-Hoops, on a three-foot Iron-trevel or frame.
4. The Crucible in which the Silver is to be melted.
5. The crucible in which the melted Metal (that is taken out of the fire) is to be put.
6. The copper-Bason in which the granulating is perform'd.

6. The

CHAP. 7. *An iron-roaster on which the Silver is heated and*  
 XX. *roasted.*

8. *He that tends the Grain-Kiln.*

9. *The Broom-holder for Granulation.*

10. *The granulating Vessel.*

11. *The Bellovvs to the Grain-Kiln.*

12. *The Instrument used by him that tends the Grain-Kiln or Furnace.*

Sculpture VII.





CHAP. XXI.

*How the grain'd or granulated Silver is to be assayed for fine Silver.*



Granulated *Silver* hath different Contents, therefore according to its contents the Addition of *Lead* must be: but that there may be a true Understanding of the difference, so the Addition of *Lead* (according to the Contents) must be taken thus, *viz.* to that vvhich contains fifteen *Loth* of *fine Silver*, the *Lead* must be 5 or 6 times the quantity, and to that vvhich is *burnt Silver*, (and is 15 *Loth* and three *drams* in the *Contents*) to such there needs but four times the quantity. But if the *Grains* are from 12 to 14 *Loth*, then take to one *Mark*, ten *Marks* of *Lead*, and upon 14 *Loth Contents*, take nine quantities, from 9 unto 12 *Loth Contents*, take 16 quantities; and from one to eight *Loth-Contents*, take 18 quantities: and although upon some *Contents* there might well be one or tvvo quantities more, than one too little: so that the Proof may have its due of *Lead*, and if the proof is right governed there vwill be no vvant.

When you are ready to assay such *Grains* or *old silver*, then set first the *Coppels* into the *Oven*, and not above tvvo *silver Tryals* at a time: Let them be vvell *neale'd* and heated, and then put the vveight of the *silver* or *grains*, to two equal *marks* of thy penny weight, place each of them into a small *Test* or put first the prepared *Lead* for the proof upon the *Coppel*, and let it begin to vwork, and after it, also the *weighed grains*; govern the *fire* by covering the *Furnace*, as also by putting

Section.  
1.  
The difference  
of Contents of  
Graind  
Silver.  
2.  
The difference  
of Quantities of  
Lead.  
3.  
Assay  
Grains.

Q

CHAP. XXI. ting the Instruments under the *Muffle*, that the proof may go off alike, and pretty cool ; cause afterwards the *Grains* to shine bright, yet not over hot, that they may not bolt or fly out, else the proof will be false.

Further, know also, that the *Grains* which are rich in *Copper* (and can endure much cold in trying) must be kept coldest, and afterwards let it shine clear (if the *Contents* be truly to be found) and that which is not rich in *Copper*, with less coolness will leave its subtil *Littarge* on the *Coppel* (as hath been said above.) But the *Burnt silver* and the very rich *Grains* cannot endure the cold because it hath no *streamy Copper* with it, and the proof would easily congeal, and if this should happen there would be no Remedy afterward, but it must be done again, therefore such proofs must go off a little hotter.

To assay  
rich Grains.

☞

5.  
When the  
Proofs have  
too little  
Lead.

But if it should happen (by not minding it) that to one proof, there should be one or two quantities of *Lead* too little, then the Proof will not shine clearly at all ; which is easily to be seen by the *Grains*, when there are little Spots upon them : as also black and wrinkly, and not very clean, such *Tryals* are false, and must be begun anew.

6.  
When the  
Proofs do go  
too hot.

Also it is to be noted, That if the proof do go too hot, then the *Lead* will carry more than ordinary, of *Silver* with it into the *Coppel* : and what one hath in the beginning of the proof, that he will finde ; only have a Care that the *Grains* (in the end) may be clean and clear, so you will finde the true *Contents*.

7.  
To make  
assay grains  
fine.

When the *Grains* are gone off clean, then they must be struck off from the *Coppels* while they are vvarm, so do they go off clean from the *Clar*, but if there should yet stick something about it, then press the *Grains* with clean flat tongs, and the unclean will fly away : Further, Brush it with an hard *Brush*, clean off, and when they are very clean, then weigh them one against another

ther, if they be alike and do stand even at the *Globe* of CHAP. the *Ballance*, then is the proof right: weigh then one XXII grain by it self, and see how many *Loths*, *Drams* and *Pence*, it hath by thy *Assay-weight*, that you may find by it, the true *Contents*, and see that the *Lead-grain* be alwayes abated, though it be never so little.

## CHAP. XXII.

*How coin'd Money in great or small Sorts may be Assayed.*



**S**HAT concerns good and *Gross Money*, as *Dollers* and new *Rix Gelders*, try them thus, Take the piece you do intend to try, beat it flat at one end, upon a smooth clean *Anvil*, that it may be cut with small *Sheers* used for *Silver*, and so cut it into little pieces, and weigh them according to your *Grain weight*, two, alike *Marks*, put this into a small *Test*, and make a *Tryal*; if it be *Dollers*: put nine quantities of pure *Lead*, and to the new *Gelders*, put eight quantities, cause them to glow off in a reasonable heat) and cold (as you have been before instructed) and such proofs (when they are govern'd well in the fire) do yield a pretty deal of fine and subtil *Litarge* on the *Coppel*, which the unexpert *Assayer* knows not.

It is also necessary to know, That neither these nor other proofs do leave any *Litarge* on the *Coppel*, if they be not done in *Coverd Ovens*, of which *Tryals* many *Refiners* do know nothing (as hath been said) therefore they do seldom bring a *Proof* to its true contents, for they know not how they must order their *Coppels* according to the quantities of *Lead*, which is of no small *Concern*, that

Section.  
I.  
of Dollers  
and rix Gil-  
ders.

2.  
To assay  
with coverd  
Assay ovens



CHAP. that they may not have too many nor too few *Asbes*,  
 XXII because, if there be too few *Asbes*, then the *Coppel* will  
 become soft, because of the much *Lead* which they suck  
 in, which easily doth draw the *silver* with it into the  
*Coppel*, so the Contents is lessened, and if there be too  
 many *Asbes* then the *Coppel* will be too big, and take too  
 much room in the Furnace, and are not so convenient for  
 use.

Section.

3.  
 To assay sin-  
 gle and dou-  
 ble Stivers.

¶

Concerning *single* and *double Stivers*, they must be  
*Assay'd* in the following manner, Take two or three and  
 cut them with *Sheers* into little pieces, and weigh two  
 equal *Marks*, or *pieces* or *parcels* according to the *Grain-*  
*weight*, and take great care that you have some of the  
 out-side for the *Tryal* to both alike, because the proof  
 that hath most of the out-side will be found richer in the  
 Contents than the other that hath not so much of the  
 outside.

4.  
 The Lead  
 quantity.

Put to each *Mark* or *Proof* eighteen *Quantities* of  
 pure *Lead*, cause them to go off pretty cool, and at last  
 to shine clear, which then also doth leave subtil *Littarge*  
 upon the *Coppel*, yet not so much as of the *Dollers*; then  
 if the *Grains* are of an equal weight, the Proof is right,  
 draw one of the two up, with the *Grain-weight*, and as  
 many *Loths* and *Grains* as you do find, so much is there  
 Content in a *Mark* of *fine silver*.

5.  
 To Assay  
 Pence.

Upon *white Pence*, *Keinisch* and other *Pence* the proof  
 is thus; Take twelve of them, and cut of each of them  
 a bit or two for a *Tryal*, only take notice that you do  
 take of such *Pence*, some *bit* where it is thick, and of  
 some where they are thin, that to each *Tryal* there may  
 be some of the thin and some of the thick *Bits*: add to  
 each *Tryal* eighteen *Quantities* of pure *Lead*, and cause  
 them to go at first fine and cool; and lastly, to shine  
 bright, so will the *Grains* be alike; but, if in the one Proof  
 there be much of the *thin*, and in the other much of the  
 thick

*thick Pence* should come, then the *Grains* would not be alike, but oft times the proof in which much of the thin *Penny* did come, that fine *Grain* will be almost two *Grains* more; and the other so much less in which most of the thick did come.

This is not much minded by some *Refiners*, but when their *Grains* do differ, then they do take the middle of it, but it is better the proof be right and that by diligence, the proofs may come out alike, because the small *Money* by boiling white doth differ in the *Contents*, so is the proof now adays better to be found than to melt a *Mark* of the *Money* in a *Crucible*, and so soon as it begins to drive, to cast it into an *Ingot*, and then to make a tryal of it so (without question) the true *Contents* will be found, and agree with the other proof made of the thin and thick *Bits*.

I must mention also, that some *Refiners* and *Assayers* are about to prove *Coynd Money* with the *Low Dutch Penny weight* (which is not amiss) because the *Contents* do agree with the *Grain-weight*; as for *Example*, Suppose you have assayed new *Gilders*, according to the *Grain-weight*, and have found that the *Mark* doth contain fourteen *Loth* and sixteen *Grains*, but according to the *Low Dutch Penny weight*, twelve pence and four *grains*, these twelve pence and four *grains* make just so much as 14 *Loth*, and 16 *Grains*, and so both of these are of one *Content*, yet of two *Denominations*.

If it should happen that an *Assayer* should be in such a place where he hath no more, then one *Centner-weight*, nor could have any more, and there should come before him *Grains* of *coynd Money*, or a *Lump* of *Silver* to try, how much a *Mark* of the same doth contain (of *Loths*, *Drams* and *Pence*, or of *Loths* and *Grains*) of fine *Silver*, he must take out of the *Centner-weight* sixteen pound, and let them be a

R *Mark*

CHAP.  
XXII

Sections

6.  
To finde the  
true Proof  
in small  
Money.

7.  
To Assay  
the Silver,  
according to  
the Com-  
mon Cent-  
ner weight.

A loth is  
Half an  
ounce.

CHAP. **XXII** Mark or sixteen *Loths*, the eight *Pound*, eight *Loths*; the four *Pound*, four *Loths*; the two *Pound*, two *Loths*, and one *Pound*, one *Loth*; after that, the sixteen *Loths* two *drams*; the eight *Loth* one *dram*, the four *Loths*, two *Peny-weight*: the two *Loths*, one *Peny*: and one *Loth*, a *Heller* or *Half-penny*.

If he hath then assayed a piece of *Silver* according to such weights, then may he find the *Contents* easily upon *Loths*, *Drams* or *Pence*, but concerning new *Gilders*, which commonly do hold fourteen *Loths* sixteen *Grains*, they will hold in such a *peny-weight* fourteen pound, and 28 *Loths*, or a little more (which would be according to the above-named *Directions*) also fourteen *Loths*, three *Drams*, two *Pence*, and almost half an *Heller* or *half-penny*, do carry 14 *Loths* and 16 *grains*.

Section.  
8.  
To assay the  
Centners  
upon Grains.

In like manner one may for *Gold* take to 24 *Carats* 16 pounds of the *Centner-weight*, and assay the *Gold* according to it, but it is better if an *Assayer* hath by hand the *Assay-weight*, already parted to make use of the same, because to mind this doth require an expert *Assayer*, for an unexpert one will easily err.

## CHAP. XXIII.

*How Burnt silver Pieces and Plates are to be cut out.*

I.  
Burnt silver  
Plates.



If you will cut-out a piece of *burnt Silver*, then first cut a piece out at the top, with a small half-round *Chissel*, not quite in the middle, nor quite at the end, then turn that piece of *Silver*, and cut in like manner a piece out of the bottom, that it may not be all from one side, but opposite to the piece that was cut at the top of the other side, that is to be cut on the back side. But

But concerning Plates, cut them out at one side above, and the other below, and weigh of each half a *Mark* for a proof, put them together in the *Proof-Scales*, that is into one *Scale*, and into the other put the whole *Mark*, opposite into the other *Scale*, if it be not just alike, as it should be, then make it so, that the *Scales* may stand equal (and assay as you have been taught).

CHAP.  
XXIV  
Section.  
2.  
Plates.

*Clear Silver* may also be cut out also above and below in like manner for to be assay'd; and so the *Contents* will always be found just when the *Proofs* have been well made.

Blink Silver

CHAP. XXIV.

How Silver Touch-Needles are to be made.



THE *silver Touch-Needles* (which are also called *Proof-Needles*) they are generally made and used by all *Refiners* and *Guardians*, and they that deal in *Silver*: by which *Touch* all *Silver-Contents* may very nearly be known: Now to make such it is very necessary to have weights that are a pretty deal bigger than common *Assay-Weights*: And then take good *fine Silver*, and of it make the first *Needle*, (and make a *Mark* on it) viz. 16 *Loth* of *fine*: And to the *Second Needle*, take 15 *Loth* of *fine Silver*, and one *Loth* of *fine Copper*: and

Section.  
1.

2.  
To make  
them.

To

CHAP.  
XXIV.

To the	Third	14	Loth of fine Silver and	} Loths of Copper.	2
	Fourth	13			3
	Fifth	12			4
	Sixth	11			5
	Seventh	10			6
	Eighth	9			7
	Ninth	8			8
	Tenth	7			9
	Eleventh	6			10
	Twelveth	5			11
	Thirteenth	4			12
	Fourteenth	3			13
	Fifteenth	2			14
	Sixteenth	1			15

Section.  
3.  
To try them

When you have weighed all these, then put every Needle's proportion into a *Crucible*, and do not let it *drive* much, for thereby the *Needles* may prove false: but so soon as the *Silver* and *Copper* in the *Crucible* begins to *drive* then stir it with a dry *Splinter* (or stick) and cast each proportion into a small *Ingot*, out of which the *Needles* are to be made, which you may shape as you please, and put a *mark* or *distinction* on each *Needle*, according to the Contents of each, thereby to see how many *lots* of fine *Silver* a *Mark* doth contain, that you may not be deceived by the *Touch*, but thereby make a right Judgment.

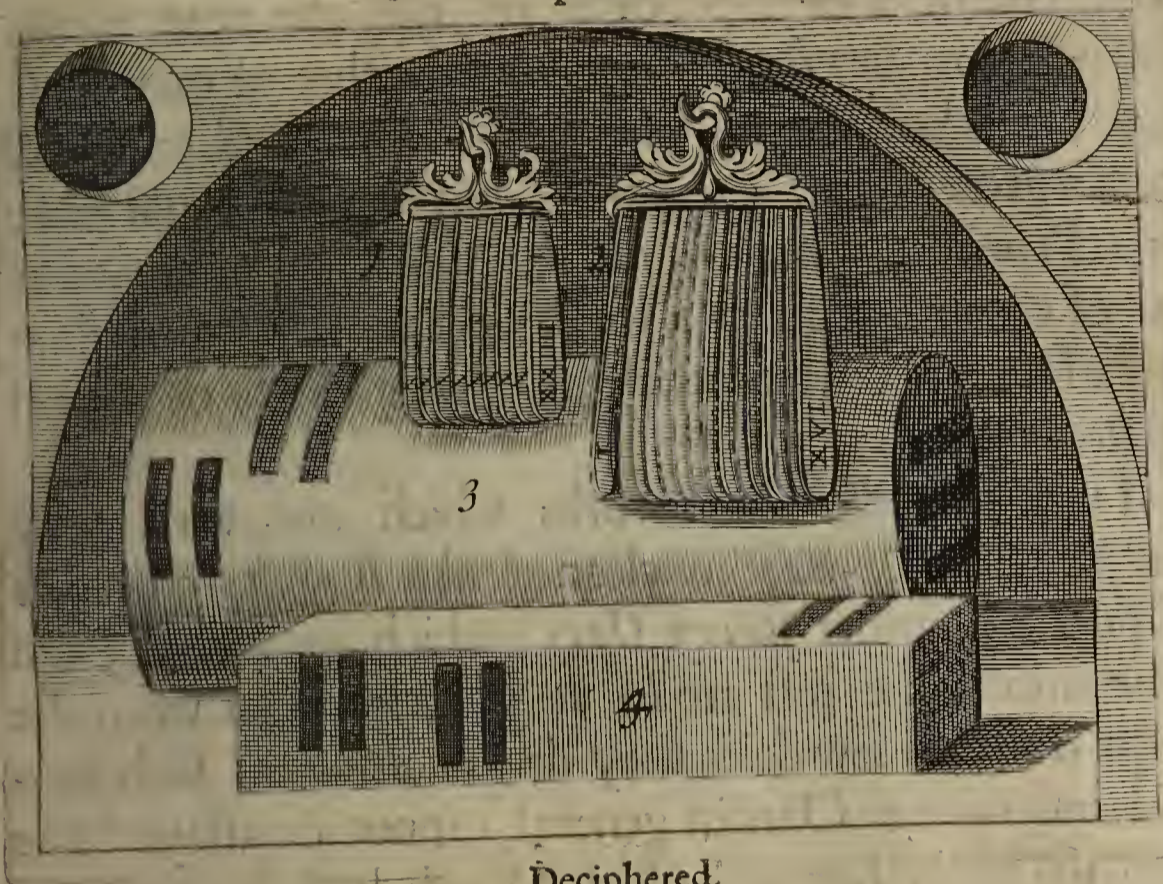
4.  
Needles  
half Loth.

Some do part and divide the *Needles* into two *half-lots*, which is left to every ones Freedom, and there is enough in it, where the *Touch* may not be certainly known by the *lot*, Now when thou dost intend to use the *Needles*, then upon the *Silver* which thou hast made, scrape a fine *shining stroak*, and also make another *stroak* on the *Needle* by it, and see which *stroak* on the *Needle* is most like the *Silver-stroke*, and so you will see by them



them how much the *Silver* doth contain : and that the *Touch - Needles* may be seen, this following *sculpture* doth represent. CHAP. XXV.

Sculpture VIII.



Deciphered.

1. 2. *The Touch-Needles.*  
 3. 4. *The Ingots to be compared with the Touch-needles.*

CHAP. XXV.

*How Mettals that are melted must be cut out, and assayed for Silver.*

**F**wrought (*lead* which is *Cast* in melting of the *silver Oars*) some are *clean* and *pure*, and others are *foul* and *unclean*; the *Clean* which come from the mild and good *Oars*, them, you may by themselves prove like unto *Lead*, and take a *Proof* out of it, when 'tis going to melt, and weigh of

Section:  
I.  
*Clean work.*

S

of

CHAP. of it at least a *Centner*, or else when the work is cast  
 XXV. forth, as much as it doth weigh is to be cut and assayed  
 together: And keep this Order, that always of the  
 whole that is *cast*, a special proof may be made, and to  
 take it out of 2 or 3 proofs: or else the true *Con-*  
*tent* will not be found, except it be that of each cast  
 piece the whole quantity be weighed in, and to go off  
 upon a great *Coppel* altogether; but if you would have  
 for a Proof some cut out of the *Cakes*, you may cut  
 out of each (especially if the *Work* be rich) according  
 to the bigness above and below, to weigh some of all, and  
 to prove it.

Section.  
 2.  
 Unclean  
 work.

There are also some works which are very *missy*  
 and *speizy* and very unclean (like *Kobolt* and *course*  
*Wismet* and other *speizy Oars*) which are melted; and  
 some among the rest are so very unclean that when the  
*Cakes* do lye a few daies, they do fall afunder: such *stub-*  
*born* and *unclean Oars*, in general, cannot be assayed like  
 unto the *good*; but when such *Work* hath been weigh-  
 ed, then cut or beat out of every *Cake* a piece, and weigh  
 it so unclean as it is, *viz.* of every cut, and assay as fol-  
 loweth: Take of the work as much as it is in weight,  
 put it on the *Test* in the *Assay-oven*, cause it to slack,  
 that the *Fury* and *wildness* may be consumed, let it cool  
 and knock it off, and cause it to go clear off from the  
*Coppel*, but if it be not *slacked* at first, but set raw upon  
 the *Coppel*, then it will work upon the *Coppel*, and will  
 not go clean off, as is shewn.

3.  
 Another  
 Custom  
 among As-  
 sayers.

Some *Assayers* do use to take the *Content* of such un-  
 clean work, and cause it to go together in a great *Assay-*  
*Test* or *Iron-Kiln*, and cast it forth, and then weigh of  
 it for a *Tryal*, which is not right (although they do  
 think they shall obtain the true *Contents*) because by this  
 running together the *Contents* comes finer, and the proof  
 is made richer, therefore the abovesaid way is much better,  
 by which the true *Contents* is found. But

But when an *unclean Work* is put upon the *Coppel*, then to imagine (when a work of it self will not go off that to add some other clean *Lead*, and to help it that way, that it may go off pure) is vain. For this cannot be a certain way of their *Proofs*, nor are you to trust to the same: Because in the *Work-houses* the *Lead* is not altogether without *Silver*, so the *Silver* is found in the *lead* that is added (as little as it is in the other *Contents*) which becomes so much richer.

CHAP.  
XXVI.  
Section.  
4.  
When there  
is lead ad-  
ded to the  
work Tryal.

Likewise as it hath been said, of *casting* and *working*, how they are to be tryed, so it must be done with *heartb Tryals*, they which are overlaid with *Silver* and rich-wrought *Lead*, and taken from the *Heartbs*, let it be good, or unclean, only that at least, the half of the whole weight may be weighed and tryed, so will you finde the *fine Silver* very near, yet not altogether fully; because the unclean that was at first in the *Work*, and hath been weighed with it (before the *Harth*. proof was taken off the work) when it is in driving was dissolved and taken off; as also sometimes the *Proof* is taken off too hot, and sometimes too cold, by this may every *Assayer* understand the *Contents*: and which (although, as hath been said, in comparison of the *Silver* that is brought forth) is not much out of the way:

5.  
Harth tryals.

## CHAP. XXVI.

*How Tin is to be assayed for Silver.*



**T**IN among the rest of *Metals* doth enter most freely into *Lead*, but the strength of the fire will not permit it to remain therewith, because as soon as there comes great heat to it, then doth it go again, and rise upon the *Lead*, and becomes altogether

Section.  
1.

CHAP. together *stubborn*, so that with no force of fire, besides  
 XXVI. other help, can it be brought to a true *Up-boiling* upon  
 the *Test*, because the *Tin* doth oft times contain much  
*Silver*, and the *Trial* of it is very necessary: Therefore  
 was I the more willing to instruct young *Assayers* of  
 the *Trial* of it, which is done thus: Weigh two equal  
*half Centners* of the *Tin*, and to each *half Centner*, a  
*Centner* of good sound *Copper*, and sixteen quantities of  
 pure *Lead*, put each *half Centner* with its *Copper* and  
*Lead* upon a *Test*, each by themselves: Begin first with  
 a slow *beat*, and when it begins to drive upon the *Test*,  
 it will begin to rise, then let it go very cool, and take  
 two *Centners* off the abovesaid *Lead-glass* put it also to  
 it, upon the *Test*, and the *Lead-glass* will cover it all, and  
 will not suffer the *Tin* to rise so much: and when you have  
 let it go *cool* so long (till the risen *Tin* upon the *Test* doth  
 no more look bright, but black and dark) then give it again  
 as much *Heat* as you can, and boyl it up (as you do  
 an unflowing *barsh Oar*) and when it hath *slack'd* well,  
 then stir it with an hot *Iron-hook*, let it stand a while lon-  
 ger, untill it be boyl'd up very clean, then take it out of  
 the *Oven*, suffer it to cool, beat the *slacks* off from the  
 work or *Lead*, and let it go off upon a *Coppel*: if then  
 the *Tin* doth hold *Silver*, there will remain a *grain*  
 upon the *Coppel*, draw it up, and you will finde the  
*Contents*.

<sup>23</sup>  
 The Lead-  
 grain to this  
 Trial.

To such a Proof must you make a *Lead - Grain* on  
 purpose, thus; Take a *Centner* of the *Copper* of which  
 you did add to the Proof, cause it diligently to go off  
 upon the *Coppels* with the *Lead* quantity: and keep the  
*Grain* of *Silver* that comes from it which (in the draw-  
 ing up of the Proof-*Grain* all times to the *Weight*) is  
 to be laid and abated, else one cannot be certain of the  
*Contents*: and after this manner in *Tin* the right *Con-*  
*contents* is to be found.

Some

Some *Assayers* are of another Opinion, to beat the *Tin* thin, and weigh of it two *half Centners*, and put every one upon a *Test* by it self in the *Assay-oven*, give it a gentle heat that the *Tin* may be wasted into *Ashes*; and into the same *Ashes* (yet every one apart) they put 16 *Centners* of *Lead* and two *Centners* of the *Flus* upon a *Test*, and boil it up like unto an *Hard-flowing Oar*, and let it go off upon the *Coppel*, this proof is also right, but it requires a little more time than the former, although the *Tin* doth also rise upon the *Plate* (yet it may easily (by governing of the fire, when it hath first cooled and afterwards very hot) be forc'd to *slack* cleanly.

CHAP.  
XXVII.  
Section.  
3.  
Another  
way to prove  
the Tin.

## CHAP, XXVII.

*How to separate Iron and Steel from Silver.*



ALSO there is found sometimes *Iron* very rich in *Silver*, the reason is, because the *Hammer-smiths* do not mind the small contents in it, also they do not know that it contains any *Silver*, and so, that *Silver* in melting cometh among the *Iron*: to prove this, that the certain contents of the *Silver* may be given in: File the *Iron* very small (which you do intend to assay) weigh of it half a *Centner*, and add to it a *Centner* of yellow *Brimstone*, and let it go off mingled well together and set it in a gentle heat, that only the *Brimstone* may flow and penetrate the *Iron*, and that it may be brought out of its substance, and let the *Iron* cool again in the *Test*, grind it again upon a *Stone* or *Iron*, and mingle two *Centners* of *Flus*, or *Lead-glass* among it; and add to it twelve *Centners* of *Lead*, cause it to boyl up (as you are wont to do, with a hard flow-

Section.  
1.

2.  
With Brim-  
stone.

T ing

CHAP. ing OAR) and in the end the work that cometh off, let  
 XXVII. it go off upon the *Coppel*, and you will find the *Contents*  
 of the *Silver*.

<sup>3.</sup>  
 with Anti-  
 mony. Some *Assayers* do use to prove *Iron* for *Silver* ano-  
 ther way, namely, they weigh the *Iron* (although it be  
 not fyled small) viz. half a *Centner* and put it in a  
*Crucible*, and add to it a *Centner* of *Antimony*, let them  
 go together, then let the *Crucible* cool, and put that  
 which did drive in the *Crucible* upon an *Assay-Test*, let  
 it smoak away, and grind it again upon an *Iron-plate* or  
*Stone* very small; mingle it with *Flus* (with an additi-  
 on of the *Lead* as hath been shewed in the proof before)  
 then cause it to boyl up clean, and let it go off upon a  
*Coppel*, but if the *Lead* be black (because of the *Ant-*  
*imony*) then set it upon the *Test* alone, cause it to slack  
 (as other wild unclean *Work*) then it will go off upon  
 the *Coppel*.

<sup>4.</sup>  
 with gross-  
 Flint. Others take small fil'd or thin beaten *Iron*, cut of it half  
 a *Centner*, as also a *Centner* of raw *gross-water flints*, which  
 holdeth no *Silver* (with its due of *Lead*) mingle it to-  
 gether and assay it (as raw *Flint* is assayed upon *Silver*)  
 so the *Brimstoue* which is in the *Flint* will devour the  
*Iron*, that it will become *Slacks*, and will then go into  
 the *Lead*, and although the *Flint* holdeth a little *Silver*,  
 yet that may be abated instead of the *Lead-grain*, and  
 this way of Assaying *Iron* for *Silver*; I have found to be  
 most fit, and it is done with little trouble, and the con-  
 tents is also found right.

<sup>5.</sup>  
 To separate  
 the Copper,  
 Iron, and  
 Silver. *Copper* and *Iron*, as also *Silver* and *Iron* love one ano-  
 ther well, and these three *Metals* cannot be so separated,  
 that a part may remain, to do any profit with: yet by a  
 right understanding of their *Nature* this is possible; that  
 from the two most constant among these three (as *sil-*  
*ver* and *Copper*) the *Iron* may be separated (being as  
 an unclean *Metal* to those two) also the *Copper* dross,  
 (which

(which is separated in the Melting and doth contain *Silver*) may be separated; which parting is done in the following manner. CHAP.  
XXVII.

The *Lead-Oar* hath commonly *Antimony* with it, which (in melting as a soft flowing Metal) doth enter into it and devoureth it) for this end, and to prevent it, a due proportion of *Lead* must be added to the *Iron* in melting (as there shall be further Instruction given in the Fourth Book) for the *Lead Oar* (by Reason of the *Antimony* that is in it) doth work upon the *Iron*, and taketh the *Copper* and *Silver* to it self, which is the Reason, that at such places where the *Lead-Oar* is melted, the *iron rich Copper Dross* (which doth contain some *Silver*) may be used with *Lead-oar* in stead of *old Iron*, which is to be put among it by degrees, and so the *Iron* will be consumed, and the *Silver* and *Copper* will enter into the *Lead*, which to my mind could not be employ'd better; but in the melting after the *Goslarish* manner, the *Lead* doth mingle among the dust, whereby it doth partake of much of the uncleanness and wildish Nature which is in the *Dust* and *slacks*, and so is left with it: But how the *Copper* is to be separated from the *Lead* will follow hereafter.

And in this manner the *Iron-stone* (that contains *Silver*) may be made to enter into the *Lead-Oar*, that it may take the *Silver* out of it, which cannot be done better; and this I was willing to impart for the better instructing of them, that Assay *Iron* and such melting works.

6.  
How the  
Coppery Iron  
which  
holds Silver  
is to be made  
to profit.

7.  
Iron-stone  
that con-  
tains Silver.

CHAP.  
XXVIII.

## CHAP. XXVIII.

*How Black or white Silver is to be burnt clean, and how the Tests for it are to be made right.*

Section.  
I.  
Deft or neat



**S**ILVER-burning is to burn *Silver* pure and *clean* and *deft* upon a *Test*, and this is to be done to the *Blink Silver* (which is not yet clean enough) by two ways; one way under the wood, before the *Bellows*) the other under the *Muffle*, and is only done with *Coales*.

2:  
To prepare  
the Tests.

But I intend to write first of the *Tests* in which the *Silver* is to be burnt clean; they are to be made and prepared thus, Take *Ashes* from which *Lees* hath been made, which are not sharp or salt: wash them and let them be dry, and keep them for your use, and when you do intend to make a *Test*, first get an earthen unglazed *test* such as the *Potters* use to make in their frames, and so large as thou wouldst have them, pour water in it, and make it wet all over, that the *Ashes* may stick the better, then put some *Ashes* into it, which must first be moistned like unto the *Copel-Ashes*, put it two fingers high in the *Test*, press it together with a wooden *Pestel*, which hath about eight Angles: then put more *Ashes* after it, press them also down, do it so long till the *Test* be full, then stroke off the superfluous *Ashes* with an *Iron* made on purpose from the *test*, and turn it about the *Brim* (with a round wooden *Ball*) so as the *Ashes* may lye smooth doon upon the *test*, afterwards cut it, with a round sharp *bent Iron*, according to the bigness of the *Silver* that is to be burnt upon it, and when the *test* is cut out, then must you have a small *hair Sieve*,



Seeve, and put ground *Bone-Ashes* in it, and swigle or CHAP. XXVIII.  
 strew it over the *test*, that it may be white all over, and  
 then turn the *Ball* over it, that it may lye smooth upon  
 the *test*, so is the *test* ready.

When you intend to use such *test*, and to burn in it, <sup>3.</sup> The manner  
 then first make a Small-coal fire upon it, that it may be of this Burn-  
 dry, then set it before the *Bellows* very even, so that ing.  
 the *Bellows* may blow just into it, which is to be known  
 thus, hold a *shovel* over the *test*, and if the blowing of  
 the *Bellows* do go off from the *shovel* and blows off all  
 the *Ashes* and *dust* out of the *test*, it doth stand right,  
 and then beat the piece of *Blink-silver* into *bits*, but first  
 put a little straw into the *test*, and the *bits* of *silver* up-  
 on it; Give it fire and coals that the *test* and the *silver*  
 may be well covered, then begin to *blow*, so the *silver*  
 will melt easily, and begin to drive, then put away  
 with an *iron-hook* all the *Coals* from the *silver*, and stroak  
 the *silver* also clean off, yet so that nothing may be lost,  
 then lay split *wood*, or other wood for fire, and  
 fit for the purpose, and cause the *Bellows* to blow under <sup>4.</sup> Wood for the  
 the *Wood* upon the *silver*, so the *silver* will begin to burning of  
 drive under the wood, and that *lead* which did remain Silver.  
 among the *silver* will be drawn into the *test*: only con-  
 sider when such split wood is burnt upon the *test*,  
 then put more wood by or upon it, that still the *silver*  
 may be burnt with a fresh flame, and so will it be sooner  
 clean, while the *silver* doth yet go upon the *test*, and it  
 must be stirred about with a round bowed *Iron-hook*,  
 and made glowing hot, whereby the *silver* may be clean,  
 or else it will retain some *lead* underneath.

But that the *Silver* may not be Burnt so much, but <sup>5.</sup> The content  
 may have a right and true content, namely, fifteen loth, of burnt Sil-  
 and three drams, (which commonly the burnt *Silver* is ver,  
 to have) then you may in the mean time once or twice,  
 with a well pointed *Iron*, (thrust a little into the *Silver*)

U

and

CHAP. and take a proof out (which will hang easily about it)  
 XXVIII. then beat it off, and see if it hath much *yellow Litbarge*,  
 or beat it upon an *Anvile*, and if it be *Deft*, then the  
*Silver* is well burned, if not put the proof in again, and  
 let the *Silver* drive longer upon the *Test*, until you do find  
 the proof upon the *Iron*, *white* and *deft*, but the *Silver*  
 upon the *Test* cannot be overdone, because the *Test* grows  
 soft from superfluous heat, and take more *Silver* to it  
 than it ought; all which is well to be observed, and di-  
 ligent *exercitation* or use is needful, if one will burn *blinck*  
*Silver* upon a certain content.

6. *How the Silver doth cool.*  
 And if by negligence, the *Silver* (before it is done)  
 doth become cool, put again *Coals* upon it, begin it a-  
 gain and burn it that it may be right, for the hard *burnt*  
*Silver* do (in *Coyning*) hurt: of which afterwards a great  
 dammage will follow.

7. *Silvers that are not burnt too high.*  
 Some of the *Refiners* in the burning of *Silver* do put  
 upon every *Mark* of *Silver* a half *Loth* or *Dram* of  
 good *Copper* that the *Silver* may not come too high, but  
 upon their just content, not that it remaineth with the  
*Silver*, but because it goes together with the *Lead* in the *Test*,  
 that the same *burnt Silver* (as we have heard) may not  
 become of such a high content; this is a good intention  
 in such places, where the *silver* for *Payment* up-  
 on a certain content are given in, and, without proving,  
 accepted, and there reasonable dilligence in burning may  
 be so observed, that none of the parts may be wronged  
 and hurt.

8. *Coppery Blinck Silvers.*  
 Whole *Coppery blinck Silvers*, such as they make in  
 the *Refining Houses*, may be burnt very *Deft*, but they  
 will remain too light on the *Content*, to the same must  
 be put a little *Lead*, (as much as it will permit) as some-  
 times likewise may be done to the *Silvers* which are mel-  
 ted of *speizy* and *Cobolt Oars* for their *Wildness* and  
 uncleanness sake.

Now

Now when the Burning is finished, and the Silver taken out of the Test, then is it to be fully quenched, whereby the Ashes will fall easily away, which stick about it, and the rest of the Ashes must be taken away cleanly, with a strong Brush, and let the Silver be dry, and when the Thornels (if there be any) and the Silver hath taken hold on the Ashes, they must be beaten down with a Hammer, that the piece on all sides may be smooth.

CHAP.  
XXVIII.

9.  
when the  
Silver burning is finished.

*But that the Reader may have a larger understanding of the Silver Burning, also how the Furnace, and Test, with all other things appertaining to them, are to be formed, is clearly to be seen by the following Sculpture, which is thus*

Deciphered.

1. *The Burning Furnace.*
2. *The Test which is put into it.*
3. *How the Silver is burnt on the Test.*
4. *The Bellows blowing.*
5. *The Iron-plates Luted over with Clay and used against the heat.*
6. *A Fork and Hook to stir the Melted stuff or Metals, as also for Iron-proofs.*
7. *An un-used or unwarmed Test.*
8. *A Test that is in warming.*
9. *A Roaster or Iron, on which the burnt Silver is made dry.*
10. *The Water-Tub over which the burnt Metals is brusht and cleansed.*
11. *The Ball and Pestle for making Tests.*
12. *The Block upon which Silver is beaten with an Hammer.*
13. *The split-wood for the Silver burning.*
14. *A Test that hath been used and Broken.*
15. *A*

CHAP.  
XXVIII.

15. A three footed stool for several uses.

16. A Tankard to put Water, into Fig. 11.

Sculpture. IX.



## C H A P. XXIX.

*How to burn Silver under the Muffle.*

**B**URNING of *Silver* which principally is used in *lower Saxony*) requireth a singular and better Diligence than the *Common silver burning*, and also particular *Tests* and *Muffles*: The *Tests* you must make thus: Let the prepared *Hoops* be of *Iron*, of the bigness as you intend to burn a great or small piece of *silver*, they must be high of a hand square, but at the top a little wider than at the Bottom, in one of them put in the prepared *Test-Ashes*, and fill it to the *top*, still beating down gently (with a broad *Hammer*) the *Ashes* about the *Brim*; and so further and further till you have beaten down all the *Ashes* that are left, or are too much upon the *Test*, stroak them off with an *Iron*, and then overturn the *Rings* and *test* alike upon a little *Ashes*, which is to be laid under; then take them with your hand out of the *test*, till it is half empty, and make the *Ashes* small again with your hands, then press the *test* full again with a heap beating it down also with the *Hammer*, as is before directed, and the rest of the *Ashes* also stroak off with an *Iron*, then turn the *test* again, and make the *Ashes* smooth with the *Ball*, then the *test* is prepared: Now the *tests* after this manner prepared are much better and stronger than they which are beaten into the *tests*.

Concerning the *Muffles* which pertain to this *Silver-burning*, they are to be made over little round sticks after the bigness of the upper part of the *test*, and are to be cut out in the like form with the *tests*; and other

Section:  
1.Tests to be  
made with  
with *Iron*  
rings.2.  
The *Muffles*  
for *Silver*  
burning.

CHAP. XXIX. pertaining Instruments which the *Sculpture* following will shew.

If now you will burn *Silver*, then put the *Test* with the *Ring* between four square burnt *Stones* in *Sand* or *Ashes*, as deep that the *Sand* may be even with the *test* above, in an *Oven* for it prepared, in which several *tests* may be put together, and such *Wind-Ovens* must have alwayes one *Wind-hole*, which may drive two *Ovens*, especially in such places wherein many pieces of *Silver* come together, and once in one day are to be burnt.

Afterwards put the *Muffle* on the *test*, which is made after its bigness, and a *burnt stone* on the top, that nothing may fall upon the *Silver*, put coals upon and under the *Muffle*, and about and upon the *test*, and when the *test* is grown warm then put in the beaten *silver*, and let it begin to work, but if you would have it soon melted, then you may blow it with *Hand-bellows*, through the *Mouth-hole* under the *Muffle*, and then it quickly goeth, and when it is melted take away the *Coals* again, and let it go also under the *Muffle*, stir it once or thrice with the *Iron*, as you have done in the other, then it will go upon the *test*, under the *Muffle*, all off: (just as the *Silvers* upon the *Coppels*.) With this burning of *Silver* both great and small pieces may be burnt, as with the *Bellows*, and without loss or any great damage upon the *Content*.

Section.  
3.  
A clean silver burning

After this manner, I have seen at *Goslar* in the *Work-house* (when it was kept) upon one *Test* on one piece near one *Hundred mark* of *silver* burning: If now you will (while the *Silver* goeth) take out with an *Iron* one or two provings (as is done in the *Silver-burning* before) you may do it (and it is not to be despised) but who in this *ART* is conversant, the same needeth not so many provings, but he knoweth it upon sight, when it hath enough.

Now

Now when the Silver under the *Muffle* is burnt clear and begins to stay, one may let water run upon it in a *Copper Channel* and cool it, then with strong *Tongs* take it out and purify it from the *Ashes*, (as is above-said) then the *Silver* is burnt.

The *Tests* may be kept together, because they are not without *Silver*, the same in some *Mine-works* the *Work-men* use to take to themselves, but in some they belong to the *Republique*: They may be made at any time to profit, and the *Silver* that is in them may be melted out, as may be seen in the following *sculpture*, and is thus

Deciphered.

1. *The Oven in which the Silver is to be burnt.*
2. *The inside of that Oven.*
3. *The Wind-holes of that Oven which drives the fire upwards into the Work.*
4. *The Test that is set into it.*
5. *The Iron Mould or Ring into which the Tests are to be put.*
6. *The form of the Iron ring.*
7. *The Ring fill'd with ashes for making a Test.*
8. *A round Muffle.*
9. *A Ball and Hammer for making of Tests.*
10. *A person that breaketh the burnt Silver.*
11. *Another person standing on the back-side of the Oven who takes Care for the burning of the silver.*
12. *A Vessel of water into which the burnt silver is to be cast.*
13. *Bellows and Instruments belonging to the Oven.*

Sculpture.





## CHAP. XXX.

*How Copper is to be Assayed for fine Silver.*



IN respect it is of use to burn the *light-*  
*content silver* fine (for many times they  
who should do it, know not fundamen-  
tally how much *Lead* is to be added,  
whereby they do too much, or too little)  
therefore to such *light-silvers*, if the

*Mark* containeth eight *Loths* of *silver*, then ten times the  
weight of *Lead* is to be added, and if the *Silvers* contain-  
eth from eight to twelve *Loths*, eight weights of *Lead*,  
and then from twelve to fifteen *Loth*, six weights of  
*Lead* must be added, but if the *burnt silvers centent*  
should be fifteen *Loth*, then the *Lead* may be two  
weight less, but if it should be wholly cleansed, then tis  
better one weight too much than one too little, that the  
*silver* may be the cleaner: And when you have put it in the  
*Test*, let it be warm, and add two weights of *Lead*, and  
when it begins to go, then draw in the *Silver* gently,  
and let it go together, and when the *Lead* is almost gone,  
then add again two weights of *Lead*, do this as long till  
the *Lead* is all put in; and the *Silver* becomes clean, and  
when the *Lead* is done and singly added) there needs not  
so much *Lead*, as when the *Lead* is added to the *Silver*  
all at once: you must not force it, but do it as cool as it  
will permit, else the *Silver* will go more into the *Test* than  
otherwise; when now the *Silver* is almost *purified*, then  
gently turn it with a glowing *Hook*, least it retain a *leady*  
*lump*, or much smoak of *Lead*, but by this way it may  
clear it self and look pure.

Section:

I.

How much  
Lead is to  
be added:

But as to the *Coppery Silvers*, if they are to be burnt

Y

fine

CHAP. fine upon the *Test* it cannot be done more conveniently  
XXXI. than under the *Muffle*.

<sup>2.</sup>  
To take the  
smoak of  
Lead from  
Silver. The *Silvers* which are to be burnt pure and clean with  
*Lead*, do retain with them a *smoak* of *Lead*, if now one  
would bring it off, the same must be set upon a plain  
*plate*, and blow it with the *Bellows*, then they may be-  
come very clean.

## CHAP. XXXI.

*How Silver is to be separated from Tin.*

Section:  
1.

A Test for  
it.



ANY times it happens that in burn-  
ing *silver Ware*, *Monys*, *Copper*, and  
other *Metals* melted together (of which  
the most part oft times is *TIN*) that the  
same cannot be made to profit, nor se-  
parated by every common *Gold-smith*  
and *Prover*, therefore let this following way be an in-  
struction (as the most convenient) namely, Put a *test* in  
an *Oven*, and a *Muffle* upon it, let both first well glow,  
and if the burnt matter be ten pounds then add upon the  
*test* twenty pounds of pure *Lead* at once together, and  
when it begins to go, then put in it of *silvery rich TIN*  
half a pound, then the *Lead* will take it soon to it self,  
which will quickly (from the great heat) begin to ascend,  
and to raise it self up; let it stand a while upon it, then  
draw it with an *Iron Hook* clear off from the *Lead*, then  
add more *TIN* to it, let it stand its time also in it, then  
draw it off also, and this infunding the *Lead* and drawing  
away, do as long till the burnt matter do all come up-  
on the *test*, and if the *Lead* in working becomes weak,  
then refresh it again with one or two pound of new *Lead*,  
that it may endure the longer in the heat; but if the  
burnt matter be *Coppery*, it is the better; if not, you must  
add

add somewhat of *Copper*, because it becomes more *Deft* by it, and the *Lead* doth take the *Silver* and *Gold* easier in than out of the stubborn *TIN* only.

CHAP.  
XXXI.

In this work the *Gold* and *Silver* will go into the *Lead*, and the most of the *Copper* is drawn off with the *TIN*, then let the *Lead* go clean off, (as the Custom is) then have you the *silver* separated from it.

But to bring the *Copper* and *Tin* (which is drawn off) to profit, it may be done thus; let such stuff dry, and cause it to melt in a strong Fire, and so the *Bell-caster*, or *Founder* may mingle it among their stuff and cast it together (as in Anno 1567. the City of *Slakenword*, in the *Bohemish* Borders was burnt down, and within the Walls of the City there remained not one House) when I myself did (after this manner) bring much burnt Metals to right, and separated the *Silver* from it, which no body else would take upon him to do.

2.  
How to  
make the se-  
parated Tin  
profitable.

The *Philosophers* do write of *precipitating*, by which the *Silver* in common *tin* may be put down, and formed into a *Regulus*; thus, one must set the *tin* apart in a little Oven, make it very hot, and then *precipitate* it, and with such a *precipitation* the *Silver* in the *tin* will be brought down a hand square, and the same in the same deepness may be cut off, and the remaining *Tin* may be again and again and so often cut off until the *Silver* in the bottom may be brought to a *Regulus*, and then (though *tin* be with it) it will purify fully, and that which doth *precipitate* will not hurt the *tin*, but they do write nothing of it: I signify this, for the sake of such, who have a pleasure to this Art, and are willing to Exercise themselves in it, and so take it into their further Meditation, that they may have hereby a way of doing it: I for my part suppose; that because the *Gold* in the *Silver*, and the *Silver* in *Copper*; is to be *precipitated*, that likewise this *precipitation* is possible in the *tin*.

3.  
To precipi-  
tate the Sil-  
ver from  
Tin.

CHAP.

## CHAP. XXXII.

*How to drive out all sorts of Silver, that it may be  
Dest, smooth and fine.*

Section.  
1.



2.  
A little  
Lead Ball.

BECAUSE it happens many times that *Silver* in casting together from an evil *smoak* (or when happily a little *tin* comes among it, or, that among the old *Silver* there hath been *tinny*, false and gross mixtures,) becomes hard : then is it, as follows, to be made *Dest*, again: Put the *Silver* upon a plain *Test* (which is done over with clean and fine *Clar*, blow it till the *Silver* runs and goes well, then add two or three Balls of very clean *Lead*, according to the quantity of *Silver*, blow it again until the *Silver* doth bear the *Bellows*, and becomes *Dest* ; but you must (in the blowing upon the *Test*) once or twice (with a glovving *Iron-Hook*) stir the *Silver* that it may be *Dest* throughout, then let it cool, and put it in a Pot together as it pleaseth you, and take notice, that if somevwhat of the *Copper* be blowvn avway, by vvhich the *silver* on the content becomes richer, then if it shall retain the Content, vvhich it had before, it must (in the casting again) be helpt by adding so much *Copper*.

3.  
To Brickle  
hard burnt  
Silver.

But *hard burnt silver*, (or other good *silver*, which might become brickle from a leady Lump) that same *Silver* (if a little *Lead* be with it) may (in this manner upon a plain *Test*) be made *Dest* without any addition; except it hath too much *Lead* with it self, then it must be

be made upon a plain little *Test* (as above is taught) by the *Silver*, burning pure and *Deft*.

Also there may a *Flus* be prepared to make the *Silver* *deft*, (which doth cleanse the *Metals* very much: ) thus, Take *sal Alkali*, *Nitre*, *Red Argol*, and *salt Petre*, of one so much as of the other, calcine, and dissolve it again in warm *Water*, and let it go through a *filter* and coagulate; so is the *Flus* prepared.

CHAP.  
XXXIII.

Section.

A Flus to  
bricke Sil  
ver.

## CHAP. XXXIII.

How to boyl *Copper* from the pagment or old *Silver* in *Coined Money*, or from thin beaten plates of *Silver*.



TAKE *sulphur* and *vitriol* of both alike in quantity, grind them small, and make them a little wet with *Vinegar* that it become as a *Pap*, mingle the *Coyn* or old *Silver* among it, then take a long *Linnen sack*, put the *Money* with these additions in it, sew the *Sack* on the sides from the top to the bottom, so that the *Mony* may not lye too thick in it, pour *Water* into a pot, and hang the *Sack* in it, that it may neither touch below, nor on the sides; boyl it well ten or twelve hours with the fire, and so much as the *Water* does waft by boyling, you must add to it again with warm *Water*, so that the *Pot* may be always full of *Water*, whereby the *Copper* will be boyled out of the *Silver* or *Coyn*, and the *Silver* will remain in the *Sack*, then wash it with warm *Water* and pour it together, but the *Water* will boyl and dry in, and the rest melt together (with the *Flus* ywhich is used to *Copper Oar*)

Z

thus

CHAP. thus you have the *Copper* which hath been boyled out of  
 XXXIV. the *Money*, only the *silver* by this is not altogether fine  
 but retaineth some small quantity of *Copper* in it.

CHAP. XXXIV.

*How good proof Ballances are to be made and fitted.*

Section.

1.  
 An Assayer  
 able to make  
 Ballances,



**P**ROVER hath not only need that he have clean and just *Ballances* for proving, but he must know also when they do fail (or else become changeable or uncertain) how to mend and help them again, so I judge it for a great piece of *Ignorance* (and it is also not well,) That some who profess themselves *Provers* of this *ART*, do often (when a little is amiss in the *Ballance*, or worn out, or for any other small matter) use to send to *Neuremburg* and other more remote places in *Germany*, to mend their false *Proof-Ballances*, whereas they themselves should have so much *Knowledg* as to make and fit them with their *Proof-weights*, and *Proof Instruments*, so as they may be certain and sure of their *Proofs*.

2.  
 And how to  
 help their  
 Defects.

Therefore, That a fundamental Instruction may be given, I will instruct all who do love this *Proof ART* (especially the young *Provers*) because there are not always *Masters* to be had, who know right well to mannage such things: and to teach how the *Proof-Ballances* and *weights*, and other *Proof-Instruments* are to be made, and also (if it be needful) to mend and rectify them: and first I shall begin with the *Proof-Ballance*, which is to be made as followeth.

3.  
 The Balz  
 lance of the  
 Proof-  
 scales.

Cause a small *Ballance* to be forged out of the blade  
 of

of an old Sword, that it may have a little broad and thin *Tongue*, and throughout be pure and well wrought, and nothing ruff or *shivery* be on it; this formed *Ballance* make fast with a little *Screw*, and file the thickest part, and then search the middle on the same place, and make a little hole with a *drill* through it, and fasten a round point in it, that it may stand out at both ends; fit it in, with thin *bits of Brass*, and *soder* it (with *Silver-soder*) fast into the *Ballance*, so the *soder* will easily flow after the thin *Brass*.

Out of this *sodered* point are filed the little *Irons* on which the *Ballance* moves, and afterwards the little *Tongue* beaten thin upon a smooth *Anvil*, and glow it often in a small *Wood-fire*, that it may not crack, then search the middle of the *Tongue*, from the *Wartz* or little *Iron* streight upward unto the end of the same (and its length is to be the same from the *Wartz* to the end) and mark it with a stroak, then cut upon the one side of the *Tongue* next to the stroak a bit of the *Iron* clean off, and on the other side of the *Tongue*, cut some also close by the *Wartz*, that the *Tongue* may rowl over from one side to the other, then may you also cut off the rest of the *Iron* on that side, when this is done, then glow the *Tongue* and dress it again straight upwards, then file it (upon a soft piece of *Wood*, very smooth, according to your pleasure; you may also pierce (or make holes) neatly in the *Tongue* near the *Ballance* for curiosity sake) afterwards bend a little the two ends of the *Ballance* alike, before the *Ballance* be quite fitted, that the two ends may be of equal length, and then file the *Ballance* according to shape and form, as a well proportioned *proof Ballance*, and so make an end; but how the filing and other *Work* is to be performed, that cannot be written, but it requireth a dilligent exercise.

CHAP.  
XXXIV.

Section.  
4.  
*Tongue.*

*Wartz*  
See the Dic-  
tionary.

The

CHAP. XXXIV. The *Fork* in which the *Ballance* useth to hang, that must also in like manner be subtilly Filed, also the holes (in which the little *Wartz* come to lye) may be thin, clean and strait through it, and must be *pollisht* with a smooth little *Stone*, that no shivers may remain, which *Fork* must be so long as the *Tongue*, that the *Ballance* may not slide out of it.

Section. 6. How the filed *Ballance* is to be proved. \* *Hematbitt.*

When the *Fork* is prepared, then take the *Fyled Ballance*, and hang it in the *Fork* with the *Tongue* downwards, and see if it be alike weight on both sides, if you find that one side is heavier than the other, you must help it until it does hang even, then make it smooth and clean all over with a gentle *Fyle* or with a soft *Whetstone*, and pollish it with the hard \* *Bloudstone*, (which is called *Glasscup*) when the *Ballance* is fully finished, then prove it again, that the *Fork* may hang even, and that it want nothing. But if there is no *smith*, which can forge the *Ballance* with the little *Tongue* (because all *Smiths* cannot make it so well of one piece) then take a clean *steel Wyer*, or a *forged Iron* in the form of a *Ballance* without the *Tongue*) and *soder* it with *silver soder*, and fix the little *Tongue* upon it, the *Tongue* may also be *garnisht* vvith *Brass*, aftervvards File a *Ballance* for it, (as hath bin said above) but if you vvill not take the pains to *Garnish* it with *Brass*, then may you take *Gold-soder* and *soder* all vvhat is necessary about the *Ballance* very cleanly, because this *soder* vvill flowv upon the *Iron* vvithout any addition or increase, and if any thing doth break upon it, it may be neatly *sodered* with *Gold soder*, as experience vvill teach.

7. Golden solder.

8. To cause the proof *Ballance* to be *blew*.

The proof *scales* are used to be made *blew*, (that they may not rust so easily) and is done thus, cause a pretty thick *Iron* to be warm in the fire, but do not suffer it to be quite brown, lay the *Ballance* with one end upon it, and draw it a long as it takes colour and becomes *blew*, which

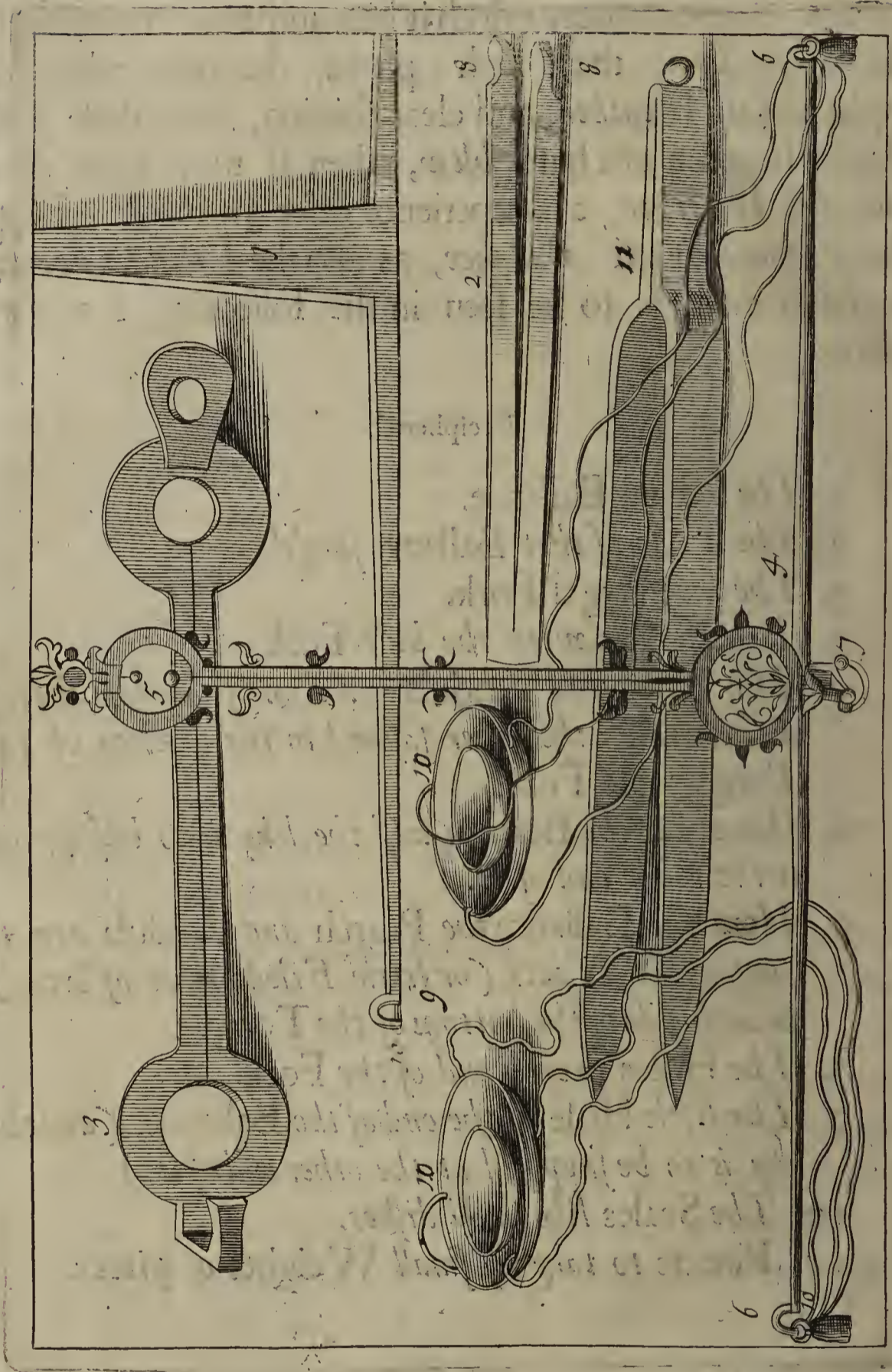


which is soon done, only take notice the more a place CHAP.  
is thin, so much sooner doth it heat and cool, therefore it XXXIV.  
is soon seen, that such places do turn white a-  
gain in *fair Weather*, and clear shining, and these Bal-  
lances become of a fairer *blew*, then if they were done  
in *dull Weather*, as experience does manifest. Now  
how that forged *Ballance*, as also the *Filed Scales* are  
to be formed, is to be seen in the following *Sculpture*  
thus

## Deciphered.

1. *The forged Ballance.*
2. *The Fork of that Ballance forg'd.*
3. *The half forg'd Fork.*
4. *Filed Scales with the half Fork.*
5. *The Pearl and Pendula's, the one fastned on the top  
of the Fork, the other fastned to the bottom of the  
Tongue and Fork.*
6. *One end of the Beam, (and the like is to be suppos'd  
at the other end of it.)*
7. *How the Ballance the Pearch and Pendula are to  
hang, on the Wartz (or little Filed pieces of Iron,)  
on each side of the bottom of the Tongue.*
8. *The Holes in each end of the Fork.*
9. *The little Hole at the end of the Ballance, (and the  
like is to be supposed at the other end of it.)*
10. *The Scales like small dishes.*
11. *Pincers to take up small Weights or pieces.*

Sculpture XI.



CHAP. XXXV.

Of Filing or Joyning the proof Ballance or Scales.

**F**ILING and Joyning of proof Scales is a special Science, and is the true Master-piece, which is not known to every one that can make them, and is done thus; when the proof Ballance is Filed out, (as hath been said before) then make, of Silver, two flat clean and smooth scales, and also two very thin small scales, the which are called inset scales, which altogether are to be as heavy as the Ballance, or rather a little heavier than lighter, and put fine silk Thred to them, in length of the whole Ballance, from one end to the other, such Threads are to have a neat Knot on the top, whereby the strings may hang to the ends of the Ballance, and when the strings are made fast to the scales, then weigh them one against the other, with another proof scales, and see if they do weigh alike, then hang them to the ends of the Ballance, put the inset scales therein, and hang the Assay-ballance in a Case made on purpose, and draw them up gently, if then the scales do turn on the one side; that is, when you do press the scales down on the one side, that the scales remain down, as also on the other side, and will not go back but remain standing, then the fault is in the Beam, that on the same places is fitted too high, from which the Ballance falleth on both sides, and will not stand just; if you know this, then make the Beam on both sides somewhat lower, but so that it be not higher on one side than on the other; to the rectifying of this, you should have a little smooth plate of Pear-tree,

Section:  
1.  
To fit Scales:

2.  
The weight  
of the Scales  
to the Bal-  
lance:

3.  
The Knots:

4.  
When the  
ballance fal-  
leth.

CHAP. tree, upon which make a *Cross stroak*, and in the midst of  
 XXXV. the *Cross* must be a little *Hole*, and upon this lay the fi-  
 led *Beam* of the *Ballance*, so that the little *Wartz* in the  
 little *Holes*, and the *Beam* and little *Tongue* may come  
 to lye upon the *stroak*, then you may soon see how the  
*Beam*, the little *Tongue*, and the *Ends* are fitted, that so  
 you may help and fit it.

So when the little *Beam* is thus prepared, that it may  
 stand near the *Ends*, a little lower than the *Line* upon  
 the little *plate*, then lay it in the *Fork*, in its place; give  
 it the right *quickness* so that it draw well and distinctly  
 the smallest of the *Weights* of the *Proof-Weights* (and  
 not stop in its lodge) nor have too much room (that is  
 to say) that the holes below of the *Fork* may not stand  
 too far off from the little *Wartz*, but only that one may  
 see through to try it.

Section. Now, when the *Proof-Scales* are thus made with  
 5. the greatest dilligence, see that it has its quickness, and  
 To make the does not stand; also that there be no fault neither in the  
 Ballance, to Beam or little *Wartz*, it must stand right both with the  
 stand true. *scales* and also without them, if it doth not this, but goes  
 heavy on the one side and light on the other, there is the  
 greatest fault, which to mend many do not understand;  
 but thus is it to be done, help the *Ballance* above on the  
 one end, and on the other side on the *scale*, (that is thus)  
 bend the one end a little down, or a little narrower, then  
 doth it give presently the *Ballance* on the other side,  
 weight, for the length, and takes so much from the other  
 side of the *scale*, that the *Ballance* may stand in again in  
 the *Fork*, then try it again whether it do well either with  
 a *Burthen* or without a *burthen*, and that it may have  
 its right quickness; but if it does not so, but goes still a  
 little at one side, then have you done too much, then help  
 it with bowing back of the *end*, and the *scale*; but if you  
 have not bowed the *end* on the right side, then the *Bal-  
 lance*

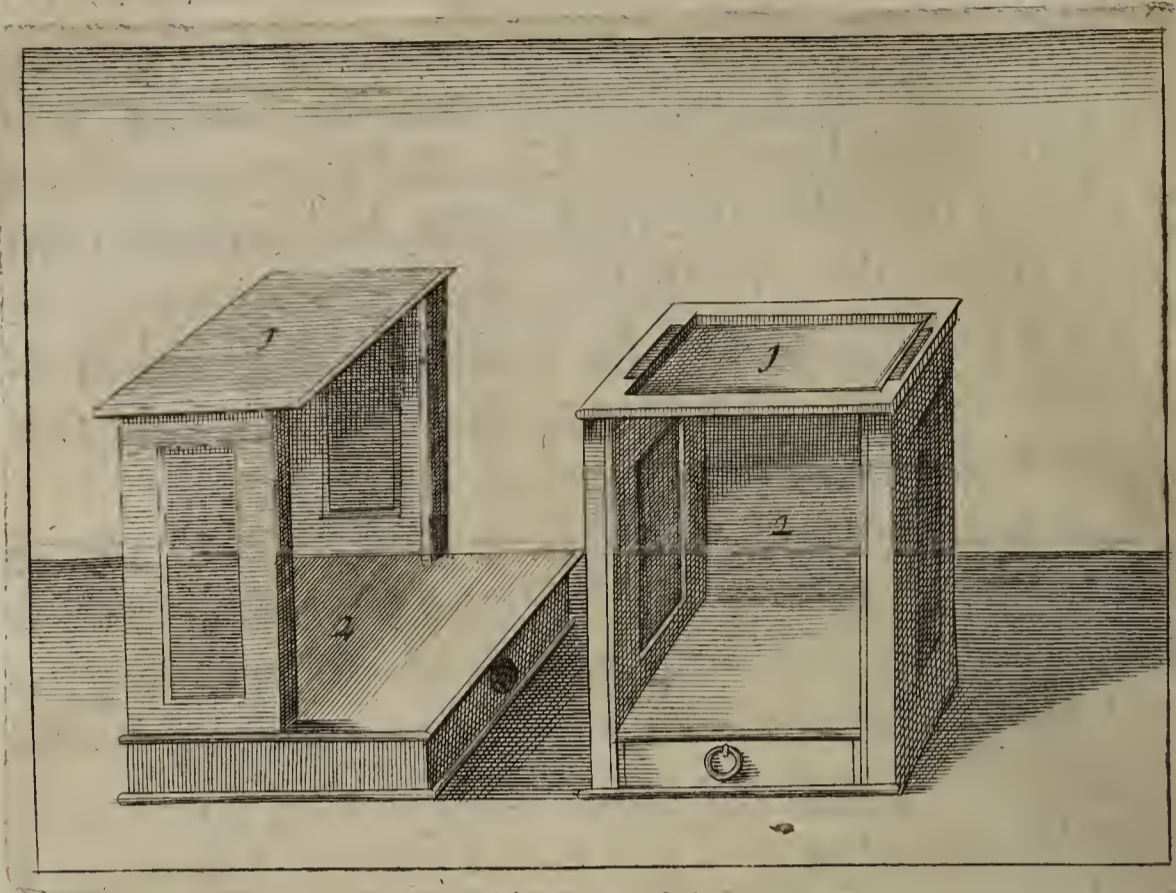
*lance* will go more false; therefore you may easily see on which side it is to be helped with binding and fitting them, and you may also use this dilligence, that when you have bent the end on the one side, and that you also do the like on the other side of the *scale*, but make it even with *Weights*, that the *Ballance* may stand right in the *Fork*, by which you may see how it doth stand in either with *Weight*, or without, and then it is easily to be corrected.

It requires great Pains to fit a *Ballance* thus, for it doth try many times a *Master*; yea, it maketh him so err, that he cannot know oft times how further to proceed: yet this way which I have here proposed is the best to such a fittingness: and it must certainly be managed by an ingenuous, and not a dull Soul. Thus much I thought good to signify, for the clearer Instruction, because 'tis very pertinent to our present Discourse of *Proving*, therefore I omitted it not.

And that the *Proof-Ballance* may be preserved clean and pure from Dust, and also that in time of use the wind may be no hindrance, but stand firm, therefore it is to be put in a clean and well formed *Proof-Case* made of *wood*, which on both sides is to be set with bright and clear *Glass*, that the *Light* may come into it, and that all things may well be seen (the Form is shewn in the following *Sculpture*: And, for conveniency of the Sight, it were best to colour the Inside of this Case *green*, because the *Fire* is hurtful to the Eyes, and by this colour they are again quickned and refreshed.

Section,  
6.  
The Case  
for the Proof  
Ballance.

Or, oyl Paper.



Deciphèred.

1. *The Out-side of the Case for the Ballance.*
2. *The In-side of that Case wherein the whole Ballance is to hang, and be kept from Dust.*

## CHAP. XXXVI.

*How Proof-Weights are to be made and divided, and first of the Grains Pence and Carrat weights.*

Section  
I.  
*To be made  
of Silver or  
Brass.*



daubeth not,

BECAUSE both the making and parting of the *Weights* is no small thing, therefore I am obliged further to demonstrate how, and of what such are best to be made: First, it is better they be of good *Silver* than of *Brass*, for the *Silver* neither coloureth it so soon as *Brass* doth

doth, but remaineth all times pure and clean, if CHAP. XXXVI.  
 now the Silver be cast into an *Ingot*, then one may cut out four square pieces in the proportion and bigness (as every piece of Proof-weight shall weigh) heavy or light, and file all such pieces pure and clean, upon a *Whetstone*, draw them smooth: also every one in particular (in respect of the Division) is with diligence to be put upon the *Proof-Balance*, that if it be still too heavy, it may be made lighter, and true; and so lastly, it may stand just. But some *Provers* think one should make and divide the *Proof-weights* from above, that is from the *greatest* still to the *smallest*; again, some from the *smallest* to the *greatest*; but know that it is best to be done in the following manner.

If *Proof-Weights* are to be prepared anew, they must be divided from the *greatest* to the *smallest*, for this Reason, Because one may better and more easily have the just and certain weight of a *Mark*, than of one from the smallest, as from the *half-Grain* or *Heller*, and should make a *Weight* out of it, there the *Mark* would be either much too heavy or much too light, in which an error is easily committed, Therefore use, in such a dividing from above, a small *Grain* of *seved* and *wash'd* *Copper*, by which may be seen how much must be taken away and filed off from a piece, which is yet too heavy; when now such *Proof-weight* is finished, then shall it be drawn up from below, from the smallest to the greatest with diligence upon a quick and good *Proof-Balance*, and if there is yet any want, which cannot be great, that it may be compleatly helped.

Now, how the *Proof-weights*, piece by piece are to be divided, may be seen in the IX Chapter of this first Book.

CHAP.

## CHAP. XXXVII.

For dividing the Weight of the Centner.

Section.

1.  
Carrats.2.  
Unequal  
parts.

AS the *Grain-Penny* and *Carrat Weights* may certainly be divided from the highest to the lowest, so it may be done with the *Centner-weight*, but because in the pounds there are *unequal parts*, understand it thus, The *Centner* hath a Hundred pound: the half, 50 pounds: and the fourth part, twenty five pounds; and if one would out of it divide sixteen pounds, (which one that is not well skilled in Division may have great labour therein) then you should do thus, when you have made right the Division of the *Centner* to the *fourth part*, then weigh the *fourth part* of the *Centner* with a *proof weight* (it may be a *Centner* or *penny-weight*) and how much it weigheth, then you may make your account how much sixteen pounds shall weigh: (an example.) I put, the new divided twenty five pounds which do weigh on the *penny-weight* 13 *lots*, three *drams*; then I say, the twenty five pounds will weigh one *Mark*, thirteen *lots*, and three *drams*, which may weigh sixteen pounds, which amounts to nineteen *lot*, no *dram*, no *penny*, one *beller*, and do prove a little more than a fourth part of a *beller*, so much then must weigh sixteen pounds, after this weight or sixteen pounds: divide your weight with *small grain'd Copper*, (the smallest as you are informed before) and although the *Centner* had more pounds, nevertheless the *unequal* division of it may likewise be found.

Now when the *proof weight* is all perfected then draw it up likewise with dilligence from the smallest to the greatest



greatest, as you have done with the other, if there should be found an Error, then mend it also, so there will be small Difference, and the *Centner* will remain in the desired *Weight*. CHAP. XXXVII

But that you may be sure whether the *Proof-weights* be right and just, set them aside, and make one *Proof-weight* more, as heavy as this, then put the *made weights* which pertain to a *Proof-weight* altogether in a quick *Proof-Ballance*, and weigh them one against the other, and if they stand even together, then you have made them right; if not, and that thou findest them not alike, then look where the Error is, and mend it, for, whoever will be sure of his *Weights*, must not think much of this Labor.

Section:  
3.  
Whether the  
Proof-  
weights are  
made right.

Lastly, *Number* and *Mark* every piece of the *Proof-Weight* with a small *iron* or *steel Punch*, how much each piece doth weigh, by which it may be known: (but the marking must be done after its made smooth on a *Whet-stone* whereby the *Shivers* which it had from the *Stamp* may be made smooth again) and lay them into a little clean *Box*, made on purpose of wood (the form of which is to be seen in the following *Sculpture*) in which there must be as many little round or square *Holes*, as there are weights, then shut the sides that it may be kept from *Dust*, and that the *Weights* may remain clean and pure. The *Sculpture* is thus

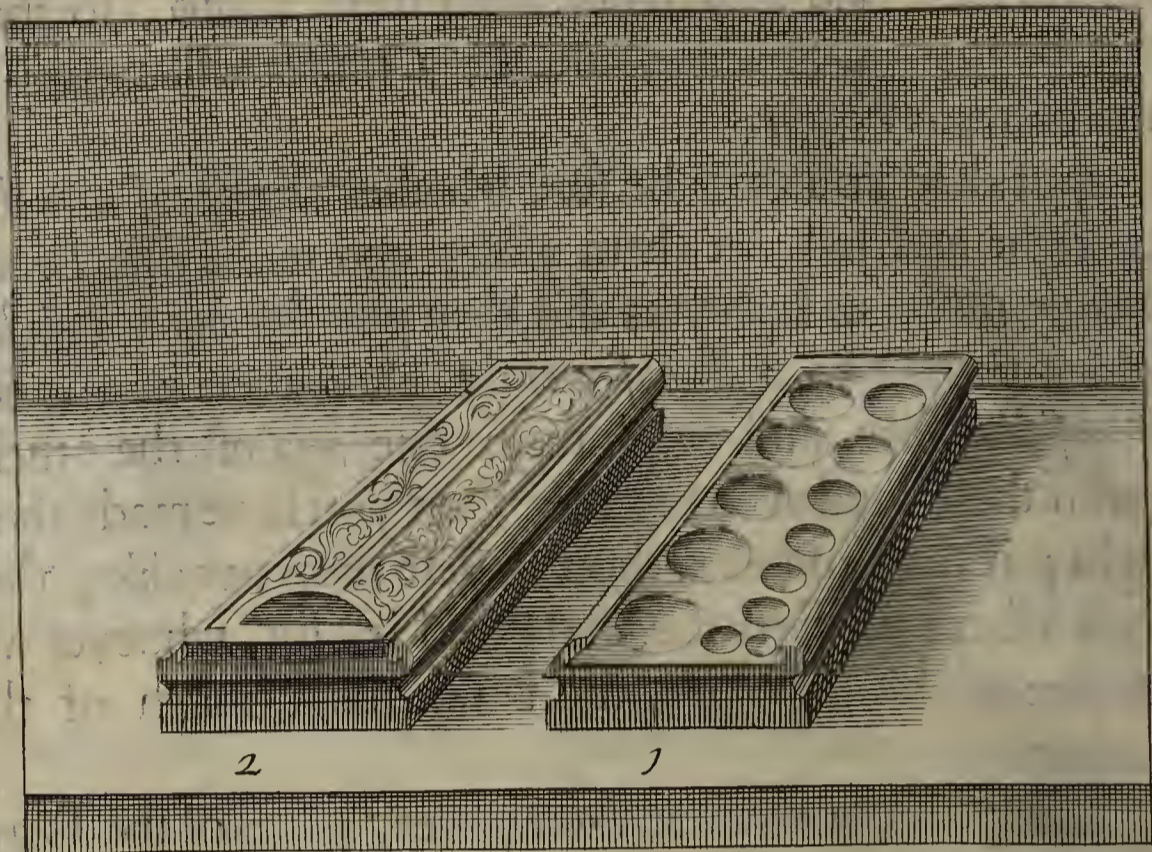
4.

Deciphered.

1. The little Case for *Weights* opened.
2. The same Case shut.

C c

Sculpture



5. Thus much I was willing to signify and write concerning the *Proving of Silver Oars*, and what appertaineth to them; and though it had seemed needful to Instruct, How such and every particular *Oar* according to their Natures and Properties, should be melted and made to more Advantage in the great Fires of Furnaces and Smelting works: yet because, in this *Treatise*, I have only purposed to write of Proofs in *Small Fires*, and lesser Ovens, and because these now mentioned works are almost common in the Smelting and great Mine-works: Therefore I am willing to let it rest here; yet some *great Works* and *Meltings*, I have mentioned (in this and other Following Books) because thy are not so common, and meerly for the Instruction of other *Assayers*.

The End of the first Book.

OF  
**Golden OARS.**

**BOOK II.**

**CHAP. I.**

**CAP. I.**



**T**HIS *Second BOOK* describeth how *Gold oars* are to be known, and how to *Roast Boil* and *Prove* them; also of *Washing, Purifying* and *Quickning* the *Gold Wash-works*: and further, how *Touch-Needles* are to be made, and to *Divide* the *Gold-weights*; also to *distill Aqua Fortis*, and to *rectify* it: also how *Silver* and *Gold* are to be parted by *Aqua Fortis* and by *Fusion*; and to make the *Gold* *dest* to *cement* it, and give it an *high Colour*, and how it must be cast through *Antimony*, and be brought to its *hight* with the *Ovens, glasses* and *Instruments* which are used to all these.

Section:  
1.

The Knowledge of *Silver-Oars* having been now treated of; We proceed to the *Gold Oars*, (although they are not found in so many Kinds and Colors) which must after their external Modes be known also, together with their *proving* and *ordering* of them. But they have this Condition attends them, (as Experience hath taught me) That no *Oar* hath *GOLD* only of it self, without other *incorporated Metals*, unless it be ap-  
parent

2.  
To know  
Gold Oars

No oar by it  
self Gold.

CAP. I. parent and seen, how small soever it be intermixed with  
 Section. them, and the same *Gold*, which is thus to be found in  
 these Oars is not wholly pure and clean, but common-  
 ly *Silvery*, although one more than the other.

4.  
 Gold in  
 Horn Oar.

Now, the fair *Gold* that is found thus *Intermixed* or  
 commonly standing in a *whitish Flint*, and sometime in  
 a blew and yellow *Horn-stone*, and also in a *Blew shiffer*  
 streamy and yellow iron, but very small and flaming with  
*Gold*, and this is found in the Mine at *Knein*, two miles  
 from the *Eal* in *Bohemia*, towards the West, where there  
 is also found a *grenish Silvery Flint*, in a firm *Quarry*;  
 and when this is ground and wash'd, then a fair and  
 high *Duke Gold* comes out of it, which otherwise is not  
 seen in the *Flint*, at the present: I know no place in  
*Germany*, where, out of any Oar, any higher *Gold* can  
 be made.

5.  
 Gold in  
 Woolfrain.  
 Tin, and  
 Iron Oars.  
 \* Shurl, ger.

Further, all *Goldish oars* (which are commonly *sandy*)  
 have good *Duke gold*, yet not all alike, some are  
 gross and in *grains*, others are flaming and *light Gold*,  
 and there is almost in all such works a heavy *Temper*  
 (or *wolfram wash*) especially in *Tin* and *Iron stone*, which  
 with the *Gold* have been driven far by the *Deluge*, and  
 it is both wonderful and neat, and the work and colour  
 and difference may easily be discerned, of these sorts: and  
 the *Rivers* and *Channels* which do flow over such works  
 are so seeded with it, that *Duke gold* in many places is  
 found in them, not only in remote *Kingdoms* and *Coun-*  
*tryes*, but also with us in *Germany*, it is brought to pro-  
 fit, yet in *Germany* for the most part it is poor, and can-  
 not bear the charge of *Washing*.

6.  
 Why the  
 Rivers  
 carry Gold  
 with them.

7.  
 Of the Ri-  
 ver Nile.

But some old *Writers* say, That (out of the River  
*Nile* in *Ægypt*, which did flow into the Sea in the  
 time of the *Deluge*, in which all Sand was brought toge-  
 ther) other *Rivers* and *Channels* have also been seeded  
 with *Duke gold*; But, to this I cannot consent, for this  
 Reason

Reason, Because this River is very great, and goeth through that part of *Ethiopia*, (which is called *India*) in which also is found much *Gold*, and it is said to be the greatest of all other *Rivers*, and doth flow the furthest; yet I esteem it much too small to enrich so many *Gold-Mines* with *Gold-sand* and channels in so innumerable places of the *World*. CAP. I.

There is also with us in *Germany* all sorts of *Grains* which are found in many *Mountains* and *Channels*, and are carried away by out-landish men; some of them are flinted, in part brown yellow and black, and within like *Glass*, and in form commonly round, and also square, of which, as 'tis said, *Gold* is also made: for my part, I esteem such not at all, because I have assayed many times such *Grains* in the *Fire*, and other ways tryed, but could not find *Gold* in them. But thus much I have from very credible Persons, who have assured me, That such *Grains* have not *Gold* in them, nor none is made out of them, but by such persons brought far into *Italy* and other places, for an Addition, out of which fine Colours and *Amel* is to be made, which colours and *Amel* by them is thus esteemed and sold dear, as if it were *Gold*, which also is agreeable to reason and may be believed, especially because many sorts of *Mines*, with us in *Germany*, are found which do yield glossy and fine Colours.

Section.

8.

*Grains*  
which are  
carried a-  
way by For-  
reigners.

Further, sometimes with the digg'd *Gold* (which lies in *flints*, especially in the *Gold-Mine* at the *Eal* in the Kingdom of *Bohemia*) there breaks a small grey spiffy *Oar*, which, after its colour, is called *Iron-man*, that same also is not only rich in *Gold*, but 'tis also *silvery*, therefore it is not to be compared with the other dig'd *Gold* which standeth in *flints*. Also there is found much *Gold flints* which have not only *Gold* but *silver* also, and commonly more of *silver* than *gold*, likewise *flints* which are ve-

9.  
*Gold in I-*  
*ron-man*  
*Oar.*

10.  
*Gold in flint.*

CAP. II ry copery and silvery, the silver of it is also rich in gold; as also some white flints which have no Copper at all, and but a little silver, and are goldy, but the flints which are coppery, and whose Silver hath Gold are found commonly with small flints intermixed.

Section.  
II.  
Gold Mar-  
casite.

Concerning the *Marcasite*, of which many make Fables, and do write as if it were a meer *flint*, is very rich in *Gold* (because it doth not loose the fourth part in the Fire) and in *roasting* and *glowing* becomes more and more fine: I have many times diligently enquired after it, but never receiv'd any good account concerning it, much less could I hear of one who had seen such a *flint*.

But, as far as I can comprehend, the *Marcasite* can and must be nothing else than a very good *Gold-ore*: Now whether this Name be given it, or any other, it matters not: But how these (one after another call'd *Gold-ores* and *wash'd Works*) are to be proved and try'd, shall plainly follow.

## CHAP. II.

*What Proofs and Washings the Gold-washers use in Gold-works.*

I.  
How much  
may be  
wash'd in a  
day.



*OLD-Washers* who go abroad in the Country for *Gold-washing*, and get their Livelihood by it; they have for the *Gold-works* a special proving, whereby they do observe how much *Gold* they wash in one day, and accordingly make their Accounts, whether the *Work* will bear the charge of *Washing*, and whether it be *poor* or *rich*, and to this *Proof* they use a particular *Weight*, which is divided by the weight of an *Hungary-Gilder*, after the worth

worth of so much as is used to pay for such wash- CAP. II  
*Gold.*

But because commonly 92 *Creicers* are given for an *Hungary Gilder* weight of wash *Gold*, therefore they make forth the greatest weight as high as an *Hungury Gilder*, and sign it with 92 *Creicers*, the second piece or half of the weight with 46 *Creicers*, and so of all the other pieces, one after another, with their Worth, till to the single penny, as followeth,

Section.  
 2.  
 of *Creicers*  
 Golden and  
 a Penny-  
 Weight.

- 92 *Creicers* the weight of a *Gilder*.
- 46 *Creicers* the half *Gilder*.
- 23 *Creicers* the fourth part of a *Gilder*.
- 12 *Creicers*
- 6 *Creicers*
- 3 *Creicers*
- 2 *Creicers*
- 1 *Creicers*
- 2 Penny weight } *Bobemish Money.*
- 1 Penny weight }

By these Weights every one may be informed of a grain of *Gold*, how much it is worth when weighed, therefore commonly the *Gold-washers* which go into the Lands for such Work carry with them such a Weight, with a black \* *Sicher Troy*, and a little Box full of *Quick-silver*, and a soft *Leather*, a proof *Test*, and a little *Bal-lance* (to all these things pertaining) then as soon as one of them enters upon a sandy or soft *Work*, and worketh upon it: if he finds *Gold* in it (how small soever it be) then doth he cleanse a little of it, and doth cause it to enter cleanly into the *Quick silver*, and doth afterwards press it through the *Leather*, from it, and that which doth remain in the *Leather* he puts upon a *Proof Test*, into the fire, which he doth presently kindle, either in the Of Gold  
Grains.  
Hair-Stro-  
\* Sichertro-  
egel.  
Woods

CAP.II Woods or Mountains and causeth it to go off, and the Gold to be red-hot, and what it doth afterwards weigh according to his *Creicer* and penny weight, so doth he make his Reckoning, how much of such *Oar* he can wash and make it return to an account in one day, and so in a Week.

Section.

4.

To prepare  
Boards for  
Washing it.

If upon Search he doth find by such proof that the *Wash-work* will recompence his labour pains and charges, then each one, according as he is best instructed doth wash the same, and make his profit thereby, among which there are some who do wash that which doth lye in the Fields under the moist earth, as also the Sand out of the *flowing Rivers* or Channels, and do wash it over a *Board*, in which are cut little *Gutters* and *wrinkles*, here and there, into which the heavy *Gold* will descend and remaineth; but part of it will wash over, especially if the work be rich and hath *grain Gold*; but if it doth go slow, it requires more pains.

5.  
A special  
good wash  
work.

6.  
The Bigness  
of the Rat-  
tar.

Some years past, there was found upon such *Work* and sand, by the water-side, a special *wash-Work* by which, in one day near 300 weight of rubbish have been wash'd away, and the *Gold* saved: which is done thus, There must first be made of *Brass Wire* a *Rattar* or *Seeve* as wide or narrow as the *Work* requireth, and it is to be tyed from above downward with *Brass wyer*, and it must be stretch'd fast upon *Iron-stays*, that it may not bend or rise, the bigness of the *Rattar* is to be seven spans long, and five wide, and in depth a good span, with a bottom that doth enter two thirds into the *Rattar*, and with one third part to be extended for carrying the matter out (which is to be done over with *Tin*) the *Rattar* must also have, on each side, little wooden pieces fastned to it, by which he may reach to the foremost Instruments, that the *gross* matter that doth not go through may easily be emptied.

As



As also the lower bottom under the *Rattar* must have on each side *Boards* fastned to it, that nothing may fall from the *Rattar*, for from that place the *Work* passeth from the *Rattar*, upon the *flat* hearth (which is to be thirty spans in length, and four broad) and the *Channel* through which the *Water* doth run-out must be wider than that above, and also covered-over with *Tin*: to this there is also *Water* used more or less, according as the *Work* is foul or sandy. CAP. II

This *Wash-work* serveth only for *Sandy-works*, but not at all for the clean and deft: yet because this work is not common to this day, therefore (for them that have not seen it) I have delineated it in the following *Sculpture*, thus

Section  
7.

Deciphered.

1. *The man that worketh with the Rattar.*
2. *The middle Floor whereon that which goeth through the Rattar doth fall.*
3. *The lower Floor whereon that which cometh from the middle Floor doth fall.*
4. *The Plain Receiver of that which falls from both.*
5. *The person that stands on a Board, and out of a Wheel-barrow throws the Matter or Oar, into the Tunnel, which guides it into the Rattar.*
6. *The Channel in which Water doth run into the Rattar.*



Section:  
8.  
Of Scirring  
Gold Oar.

Then some of the *Gold-washers* use upon their hearths the strong *Timode* black and russet *woollen Cloth*, over which they do drive their Works, because the woollen cloth is rough and hairy, so that the small and round *grains* of *Gold* will remain, and not run forth (as it will from the *Timode*) whereby the *Gold* (upon the black Cloth may apparently be known, though it be small and little.

Others

Others use in stead of the *Timode* or black woollen Cloaths *Linsy-woolsy* (half linnen and half woollen; wrought in themanner as the *Timode* is) upon which the *Gold* doth stick better, and such *Cloths* do last longer, because of the *Linne* that is among the *Woollen* which doth strengthen it, therefore it is better for this *Work*.

But there is another way of *Washing* (not much in use) which is called *Driving and Washing through the long Rattar*; but according to my mind, it is not so convenient a way for the small *Works*, which have great and small *Gold*, and are both sand and Clay together, yet I do not much decline from the before described *Rattar-work*: For, in this Labor or washing, because of the turning in the upper and lower falls, the running *Gold* is preserv'd better, and the *Gold* goeth with the small common *Work* over the plain hearth, upon which it is driven: and the manner of doing it is seen in the following *Sculpture*; thus

CAP. II

Section.

9.  
The sorts of  
cloth to be  
used for  
seircing it.10  
How to use  
the long  
Rattars.

Deciphered

1. *The Miner which carries the matter to be wash'd in the Rattar.*
2. *The Parts of the Rattar, more visible than in the former Sculpture.*
3. *The Washer that governs the Rattar.*
4. *The upper and lower Falls from the Rattar.*
5. *The plain Boards, or Hearth) on which they fall.*
6. *He that stirs about the muddy water from both Fallings.*
7. *The Tub wherein that which falleth from the hearth is to be wash'd.*

Sculpture



Section.  
11.  
To purify  
the Gold  
Slicks.

Thus much I was willing in short to discourse about the *Gold-Washing*, as a **D**irection how the **W**ork is to be done to Advantage. If now a **W**ork be rich, then it is the better, and then may easily be found and used a manner of **W**ashing, that the loose *Gold* by it may be preserved: and when the *Slick* is brought into a narrowness, and the *Gold* drawn out with the great Instrument, or with the slender and long one (which is called a *Saxen*)

*Saxen*) then may it be quickned and pressed through the *Leather*; then glow out and cast all together, of which more shall be written in what followeth.

CAP. II  
Section.

Thus far I have spoken of the *Gold* and *\*wash-works* which do need *Boxes*: Now I intend to write also of the *Gold Oars* which are had in the *Mines* out of the *Veins*, and how that must be *buckt* or *washt*; in which the *digg'd Gold* is clearly to be seen, and such must have a special way of preparing it ) namely, those *Oars* in which the *Gold* standeth in great *Grains*, and may be parted with the hand, or beaten in a great *Iron Mortar*, and, if there be much, then set it over a *Seeve*, made on purpose, and so cleanse it, and it needeth no more pains, nor greater Art: and it is better than that the *Oars* (without difference) were brought under the *Buck*, or washing place (especially because one useth to observe such a hand parting in smaller *Mettals*, as *Silver*, *Copper* and *Lead Oars*.)

\* <sup>13.</sup> *Seyfen*  
or *Soper*.Of great  
Grain'd  
gold.

But the poor *Gold Oars* which are mingled with small *Gold* (and cannot be separated with the hand) the same if they can be wrought without *Roasting*, may be *Buck'd* and prepared two wayes, *viz.* by a wet and a dry *Bucking* or beating; by the wet *Bucking* is the *Oar* washed through *Tin* plates and *Channels* (and like unto *silvery Oar*, driven over a plain *Hearth*, and afterwards made clean) but in the dry beaten *Work*, the *Floor* is driven over the plain *Hearth* with *Wool-*len or *Linsy-Woolsy* stuff (as above, where the *Gold-work* hath been taught) and so wash'd and made clean and quickned.

<sup>14</sup>  
How digg'd  
Gold is min-  
gled.

There are also *Flinty* and *Horn-stony Gold Veins*, in which the *Gold* is very subtil and thin, and is mingled with other *Water-flowing Gold Oars*, the best way of preparing them is, That such *Flints* and *Horn-stones*, provided there may be had *Wood* enough in the place,

<sup>15.</sup>  
Flinty and  
Hornstony  
Gold Oars  
how to be  
us'd.

CAP.II may in a special *Roast Oven*, made on purpose, be burnt: first, very hard and well, and when it standeth in the greatest heat, pour water upon it, that it may cool suddenly, and so the subtil *flaming Gold* will be, as it were, frightened, at the incorporated *Oar*, and run together, and become a round Body, and is strengthened and remaineth the better in *washing*, also 'tis better preserv'd: likewise, the *Flint* by quenching doth become so brickle, that afterwards in great quantity, it may easily be *buckt* and separated, and is not so hurtful (after it is *roasted*) to the tender *Gold*, as before when it was raw) because the hard *Flint* among the *Gold.Oar* doth more hurt in *Bucking* in respect of its weight, and the *muddiness* carrieth away some of the *Gold* with it, in the *mudy Water*, but seeing that it is very rare to find plenty of wood in such places where *flinty, Horn-stone Gold Veins* are; therefore every one is left to try the best way.

Section.  
16.  
*Roast ovens.*

The *Roast.Ovens* in which those *flinty Oars* are *roasted*, and afterwards quenched with water, make them thus: Give to each *Oven* two *Ells* in square, and six *Ells* high, and cause it to be built up with stones, that the *Oven* before the lower part may remain, open so high that the roasted *Oar* may be drawn out of the hole (after the *Oar* which is to be roasted is put in) then it must be closed up with *Clay*, also there must be in the *Oven*, in stead of the *roast*, Separations, made of *Tiles* an *Ell* high, upon which the wood is to be laid, that the *Wind* may go between the *Tyles* into the *Oven*, whereby the fire may burn clear.

When you intend to roast in such an *Oven*, then lay into the *Oven* upon the *Tile-stones*, short split wood, two *Ells* high; upon which put the *stony Oar*, as gross as it doth come out of the *Pit*, but the small which are not in very great pieces set along the sides of the *Oven*. that the great pieces may be in the middle, so that the flame and  
heat

heat of the fire may wind about it, and also the heat of the fire remain together in the Oven, and force it self through it to the top of the *Furnace*, and such for- and inclosed *Heat* doth much more than in an open *Roast*, and when the *Roast* in the *oven* burneth at the fiercest, then must water be poured on it, and be quenched suddenly, therefore such a *Roast Oven* for better Advantage is to be built in such a place where water may easily be poured into it, so the subtil *Gold* will run together in *grains*, and the stone will become brickle (as hath been said before) although the same do become brickle only with burning, yet it becommeth more brickle by quenching, and it is done more especially for the *Gold* sake.

Section.  
17.  
To quench  
the Roast.

The form of such *Roast-Ovens*, and how they must stand in its proportion and shape, will be seen in this following *Sculpture*, thus

## Deciphered

1. *The Form of the Roasting-ovens.*
2. *The Shutters to them.*
3. *The In-side of them.*
4. *The Partitions in them, made of Tile, and a person attending at the mouth of them.*
5. *He that pours Water into the top of the Oven.*
6. *The wood that is used in those Roasting-ovens.*
7. *The Instruments to close the Ovens.*
8. *The Ladder to go to the Top of the Oven.*
9. *The Pieces of Metal that are to be used.*

Sculpture.



Section.  
18.

If there be a great quantity of the *Gold-stones*, then there may be made more *Ovens*, as also bigger, and according as necessity requireth, regulate them that the Fire may have its full force.

Thus much *I* was willing to mention concerning the Preparation of the *Gold Oars*: But because *I* have not from my youth, medled so much in it, as with other *Oars*, therefore have *I* shortned my Discourse: and others that know better Methods have their Liberty to inlarge.

CHAP.



## CHAP. III.

## Of Gold Slicks.

**F**URTHER, know also that when the *Gold Oars* and *Gold Slicks* are cleared for to quicken: and the *Gold* drawn out, with the *Quick silver*, and hath been quickned, yet there will remain from the quickning a *Slick*, of which some is poor in *Gold*, and some rich, yet the rich *Slicks* may be made to profit and melted like as a rich *Silver Oar*: But the other common *Gold Slicks*, especially if they be of the *Gold-Mine* at the *River Eal*) are *flinty*, and that the *Centner* which hath but a dram of *Gold*, cannot better be melted than over the raw *Slicks* into *Slackstones*; but if the *Slicks* be not *flinty* of themselves, then there must be another *flint*, (which yields much *Stone*) added to the *Slick* in melting, and when the *slackstone* doth not come out rich in *Gold*, then add more of such *Flints* to it, to help the *Flint*, until a *Centner* of the *Slack-stone* doth contain 13 or 14 *Drams* in *Gold*, but it must not be wrought by adding more to it, because if it should become too rich in *Gold* (it is to be feared that) the *Slakes* would remain too rich: therefore, if there be enough of such *flints* to be had, let them be added to it, or if the *Slick* it self be *flinty*, and yield *stones*, then twere better that the *Slack-stone* were brought no further in *Contents*, than to 10 *drams* of *Gold* in the *Centner*, and so the *Slack* will remain the poorer: thus the *Iron flaky Oars* (which have very subtil flaming *Gold*, and commonly the *Centner* of

Section.  
1.  
Of poor  
Gold slicks.

CHAP. it doth contain a dram or two in *Gold*) may return to  
 III. great Advantage.

Section.  
 2.  
 Of rich  
 slicks.

But the rich *Gold Ram* or *Slick* (out of which *Gold* is quickned) which in part useth to be very rich in *Gold* that sometimes it doth contain a *Centner* from three to many *Loths* of silvery *Gold*, such can no better way be melted than with *Lead*; yet because that same *Slack* is very subtil, therefore the blast in melting doth raise it up very easily, so that it doth fly out, and is lost by it: to prevent this, Let the *Slick* be mingled with strong *Yest*, and let it dry, then break it into *Bits*, or before it is quite dry, cut it to small *Bits*, and put it into the *Oven*, and so it will remain better in the fire.

3.  
 To bring  
 both to Pro-  
 fit.

'Tis necessary I further direct, That when one hath a *Gold Slick*, and would melt it, and that a *Centner* thereof doth hold from two to five drams of *Gold*, and is not stony in it self, there must be other *flints* added so that the *flint* and *slick* may not be thoroughly mingled together, nor run upon the *slick*, for by this there will be danger, because the *flint* doth spread it self, and gives a little rough *stone*, whereby there will remain much of the *Gold* behind, but weigh the *flint* and the *slick*, each by themselves, and if any of it be melted, so much (according to the quantity, partly *flint* and partly *slick* and *slacks*) must be set into the *melting oven*, and it will fine it self well enough together, and by this means (as Experience teacheth) more *row stones* and more *Gold* will be wrought out, than if such *slick*, *flint* and *slacks* had been mingled together, because the work remaineth close together and is not spread.

CHAP.

## CHAP. IV.

How Gold-Slicks with Gold from digg'd Oar  
are to be prepared.



**W**HEN the *Gold-slicks* which do contain *Gold* are made clean, and there is a desire to make more profit of it, by quickning and getting the *Gold* out of them, then the slicks must first be prepar'd in the following manner: *viz.* Take good strong *Wine Vinegar*, put into every gallon half a pound of *Allum*, cause it to boyl up a little, and then let it cool, then put the *Gold-slicks* in a clean prepared Vessel, and pour the prepared *Vinegar* upon it, that it may cover the *slicks*, let it stand two or three nights in it, and work well upon it, so the *Vinegar* will make a fresh ground to the *flamy Gold*, that it will not easily enter into the *Quicksilver*, and that which is yet among it of *deft Oar* will become slimy, and the *Gold* is made less, and when the *Vinegar* hath stood the mentioned dayes over it, then separate the *Vinegar* clear from it, and wash the *slicks* clean and fair with warm water, and let it dry, then put it in the grinding Tub or wooden Vessel, and so much *Quick-silver* to it as the quantity of the *Gold* in the *slicks* doth require, and rub it well together with the hands, afterwards with a wooden Pestel, fitted for it, grind it well and so long, till the *Quick silver* hath taken up all the *Gold*; when this is done, then pour warm water upon it, and wash the *slicks* and *Quick silver* clean, and pour out the muddy matter, and the *Quick silver* will run together again: which

Section:  
1.

CHAP. which must be separated very clean from the *slicks*, that  
 IV. nothing remain behind, because it is more *Goldish*:  
 when this is done, dry it with a *sponge*; and put it in  
 a double strong *Timode* or into a fine leather (which is  
 better) and force it with a strong *Coard* so as the *Quick-*  
*silver* being so prest will pass through such *Timodes* or  
 leather, and the *Gold* with almost as much *Quick-silver*  
 will remain in the *Leather*; put this on a *flat Test* upon  
 a coal *fire*, and the remaining *Quick silver* will cooperate  
 and the *Gold* will remain alone; then glow it well and  
 melt it together before the *Bellows* with *Borax*, so long  
 till it doth hold the wind, then pour it into an *Ingot*:  
 The prepared *Vinegar* (as hath been said) with *Allom*,  
 is for the most part used by all *Refiners*, but they quick-  
 en *Gold* only simply with *slick*, but 'tis better that such  
*Vinegar* be prepared and used.

Section.  
 2.  
 To prest the  
*Quick silver*  
 through  
*Leather*.

3.  
 When the  
*Gold holds*  
*Silver*.

4.  
 To pick out  
 the digg'd  
*Gold*.

But if the *Gold* be a little *silvery* (as commonly wash  
*Gold* is, which do not come out of an higher Content  
 than they are in the *Oar*) beat it thin, put it in *Cement*,  
 as hereafter shall be discoursed, then it will be clean and  
 have a high *Colour*.

What *Gold* hath been pick'd out and is wholly digg'd  
 (or else separated by the hand) such *Gold* may be melted  
 with *Borax* and cast, and if there is yet any uncleanness  
 then set it first upon a *flat Test*, let it drive with a little  
*Ball* of pure *Lead* until it doth hold the *Blast*, and after-  
 wards again with *Borax* melted into an *Ingot*, and so it  
 will be deft.

This manner of quickning doth serve upon all *slicks*,  
 (which have digg'd *Gold*) because as the same is wash-  
 ed in *Sand*, and pick'd out of the *Oars*; in the same man-  
 ner it will come out in quickning, and doth not hurt  
 the *Quick-silver* at all, and when it is forced out, then  
 may it be used again.

There have been also some *Gold-washers* which have  
 had

had a singular manner in the *Gold-washing* and *quick-* CHAP.  
*ning*; namely, they have first ground in a Mill the *Gold* IV.  
*Oars* (or *Slicks*) very small (as small as Meal) after- SECTION.  
wards they have moistned it with strong, hot *Salt-wa-* 5.  
*ter*, and have mingled it very well like unto *Copel Ashes*,  
that the *Salt* may every where touch the *Slicks* upon  
the *Oar*; and while the *Salt water* is yet warm and hot  
they have upon five pound of the *Oar* poured twenty  
pound of *Quick silver*, and have mingled the *Slick* or  
*Oar* several times with it, and stirred it well, so long  
untill the *Quick silver* could hardly be discerned in it;  
and they have afterwards put the *Oar* into several *Ves-*  
*sels* full of *Water*, made on purpose, and have stirred  
it, but one *Vessel* did always stand lower than the other,  
that that which did fall out of the upper vessel, (and  
so to the second or third) might be received and settle  
in the fourth.

And thereby washed the most of the *Muddiness*  
away; then they have taken the *Oar* and mingled it  
with the *Quick silver*, and put it upon the *Mill* (which  
hath an hollow stone) and have ground it with water,  
that it might flow through it, untill no more *Muddiness*  
did go from it, till all that which is come through the  
*Mills* be settled in the *Vessels* and preserv'd, so that  
nothing was lost: Lastly, the *Quick silver* was taken  
out of the *Mill*, and with diligence kept together, and  
dried, and pressed through *Leather*. This Work I like  
well upon great Quantities of poor *Oars*, in which the  
digg'd *Gold* is very subtil and not *flinty*, and yieldeth  
no stone, which cannot be melted otherwise to Advan-  
tage.

This is a neat work, and is worthy of Deliberation;  
But I for my part have this further Consideration in it,  
That poor *Gold slicks*, cannot be much Charge; because,  
first, the *Slick* must be ground, and the Charge of the

CHAP. V. *Salt* or mingling, well considered, as also the Charge of the other grindings, and the waste of the *Quick silver*; but lastly, to make the *Gold* compleatly clean (besides the charges of the building up of the *Gold-Mill*) 'tis necessary to be careful herein, for, some *Gold-Oar* may have so much subtil *Gold*, as will pay richly for all the Charges.

## CHAP. V.

*How Clean Gold-slicks are to be made to profit without Quicksilver.*

Section.  
I.  
By Lead-  
glass. &c.



**N** want of *Quick silver* one may melt the clean and rich *Gold slicks* with grained *Lead*, *Litharge* and *Lead-glass* in a *Crucible* with a little of *Caput Mort.* and *Sandover*, and cover it over with *Salt*, and so cause it to flow well in a *Wind-Oven*, and afterwards cause the *Regulus* to go upon a *flat Test*, because of the *Black-stoney Veins* there will be also much fine *slick* thrust out among the *Iron*, therefore the *Iron* is first to be drawn out with a good *Loadstone*, otherwise it will be much hindred in the *upboyling*, but if the *Gold slick* be *flinty* or the like, then it must first be *roasted*, so all the *Gold* which is not loose in the *slick* will enter into the *Regulus* of *Lead*, and be made to profit.

2.  
To make  
firm Tests  
for Gold.

The *Test* to such work must be prepared with *wash'd Ashes*, among which must be mingled half the quantity of *small Bone-Ashes*, and a little *Potters-clay*, and the upper part must be done over with good *Clar*, that nothing of the *Gold* be drawn into it, and when it is all thus prepared, then water must be poured into it, and let it suck it in, whereby the *Test* will be made firm and good,  
and

and when the *Gold* is gone off upon the *Test*, then take the appearing *Gold*, which is yet unclean, put it upon a *flat Test*, done over with a little *Clar*, and let the *Bellows* blow upon it, so long until the *Gold* doth endure the blast, and so it will be *deft*, and then you may (if it have yet a little smoak of *Lead*) cause it to melt in a *Crucible* with a little *Borax*, and cast it into an *Ingot*, or presently let it go into the *Cement*, as hereafter you will be instructed.

The *rich cleansed Gold slick* may also be boyl'd up with the following *Fluss*, like unto the *Copper Oars*: thus, Take *Slick*, mingle among it twice so much *Fluss*, put it in a *Crucible* cover it over with *Salt*, cause it to flow well, with a strong heat in a *Wind-furnace*, and there will be as much *Gold Regulus* in the *Crucible* as there was in the *slick*; then cause it to cool well, and knock the *Regulus* clean off from the *Fluss*, but because it is yet unclean from the *Fluss*, therefore cause it to go off upon a *flat Test* with a small *lead Ball*, until it melts and becomes *deft*: and altho in the quantity of the *slick*, the quickning is most fit to be used, yet there may (by this *Upboiling*) be ten pound at once melted in a *Crucible*, and the *Gold* be brought into a *Regulus*.

Section.  
3.  
To boil up  
the clean  
Gold slick:

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CHAP. VI.

Of Fluss to boyl up the Oars.



FLUSS (of which hath been spoken) is made thus, Take one part of *Salt-peter* and two parts of *Argol* (both stamp'd small and mingled together) cause a glazed *Pot* to glow, put the matter into it, and cover the *Pot* quickly, so the *fluss* will be

CHAP. VII. be presently burnt out and become a *black-grey Ponder*; or else, when the pulverized matter is put into the *Pot*, then put a live *Coal* into it, so it will burn out to a *Fluss*, mingle also *Salt Petre*, melted *Salt* and *Sandover*, and crude *Argol* with it, then is the *Fluss* ready.

## CHAP. VII.

*How Gold may be separated very clean from the Quicksilver.*

Section.

1.  
The use of  
Quicksilver  
in this work.



AFTER Gold is quickned, and the *Quicksilver* press'd through a *leather* and forc'd from it, yet there will remain commonly a little *Gold* with it, especially when the *Gold-slicks* and *Gold Oars* have been poor, and that the *Quicksilver* did not become rich, such *Quicksilver* may be preserved for other *Work* of the like nature. But if there were no more such *slicks* to be done, yet the *Gold* (which did go with the *Quicksilver* through the *Leather*) must be separated from it very clean, by an *Artificial Separation*, and such *Quicksilver* doth commonly contain two or three *Loths* of *Gold* in the *Centner*, especially when the *Quicksilver* came from poor *slicks*, and such *Separation* is done thus,

2.  
How a *Iron Jug* or *Pot*  
is to be  
made and  
Loamed.

Cause an *Iron Jug* to be made, which may be taken asunder at the belly, lute the lower part of the inside, about half a finger thick, with very good and weighty *Loam*, (that will hold well in the *fire*, and not crack) cause it to dry, set the upper part upon it, and bind them both very fast, and close together with an *Iron Wyer*, and then do it all over on the outside



side with good *Clay*, and when it is dry, then set CHAP. VII.  
 it in an *Oven* (which is called an *Athamor* with which  
 one useth to burn *Aqua fortis*) and put in it fifty  
 pound of *Quick silver* (if you have such a quantity  
 of it) and place an *Helmet* upon it, and also an  
*earthen Jug* before it, in which there must be full  
 three quarts of *Water*, and all must be luted well on the  
 outside, and cause it to dry, then let the *fire* burn by  
 degrees to be stronger from one hour to the other, un-  
 till at last the *Jug* be very red, yet make it not sud-  
 denly hot, that the *Jug* may not burst, nor the *Quick-*  
*silver* fly out, so the *Quick-silver* will all come over  
 into the water in the *Receiver*, which when the fire is  
 kept in good order) is done in seven or eight hours:  
 when all is come over, then let the *Jug* cool well, and  
 take it out of the fire, and open it, so will you find all  
 the *Gold* in the bottom, then take it from the *Loam*,  
 and let it flow together.

After this manner (now directed) the *Gold* which  
 remaineth in the *Leather* (which hath *Quick silver* with  
 it) may be put in and drawn off: and the *Quick silver*  
 may return to Advantage.

But because the *Quick-silver* will become a little weak  
 from the drawing over (so that it will not attract so  
 soon as in the beginning) and if you would have it fresh  
 again, then put it into a *Vessel* of *Wood*, draw warm  
*salt Water* upon it, grind it with your hand well toge-  
 ther, and dry it with a *Sponge*, then it is as good again  
 as it was before, and you may use it again: also there  
 is no great loss by it in the drawing it off, if the *Pots*  
 and *Glasses* be well luted.

3.  
To refresh  
Quick silver

In case you cannot have always in readiness an *iron*  
*Jug*, cause one to be made of earth (which will endure  
 the fire) and lute the same likewise with good and firm  
*Clay*, as you did to the *iron Jug*; so put the *Quick-*  
*silver*

CHAP. VII. *silver* into it, and *Helmet* upon it, and set before it the *Jug* with water, and *lute* it well altogether, then force the *Quicksilver* over it, and you may have it again for use, but such Labor is performed with Sorrow and danger, because if such an earthen *Jug* should crack or spring then the *Quicksilver* will be lost, and will evaporate to smoak, therefore there must not be so much *Quicksilver* put in it, as into an *iron Jug* or *Pot*.

Section.  
5.  
Another  
way to draw  
off the Gold.

Some use to put upon such a *Jug* an earthy blind *Limbeck* (that on both sides hangeth over) and therein they put water, and draw the *Quicksilver* from the prest *Gold* in it, and when it is a little cool, they put it out through the *Pype* which is above on the *Helmet*, and then the *Gold* will remain on the *Jug*.

Now, which of these (that is found most serviceable and convenient to any one) he may use: only take notice, That, if you let the smoak away and the remaining *Quicksilver* from the *Gold* (without distillation) take heed the *smoak* or vapour go not into thy *Belly*, because it is a *poysoning* and cold *Vapour*, which lameth and killeth: for, he will find that it will there congeal and afterwards spoil his body.

Now, that the Reader may know how the *Jug* and Instruments are to be made which are to be used for quickning, and attracting, he may find exactly in the following *Sculpture*, which is thus

Deciphered.

1. *The Athanor or great Furnace.*
2. *The Ovens on the sides of it.*
3. *The earthen Receiver for it.*
4. *The earthen Helmet for it.*
5. *The blind Helmet with a Pipe by which water may be pour'd in.*
6. *He that fitteth the matter.*

7. He

7. He that presseth the Quicksilver through a Leather.
8. The lower part of the iron pot or Receiver.
9. The upper part of it.
10. The Leather purse for the Quicksilver.
11. He that causeth the Gold to melt, by help of the Bel-  
lows.
12. The Pieces of Metal.

CHAP.  
VII.

Sculpture XVII.



CHAP.

## CHAP. VIII.

*How Gold-Oars are to be proved for Gold.*

Section.

1.



OLD Oars are of two sorts, one is partly *flowing*, the other partly *barsh* (as is discours'd in the *first Book*) Now from the *silver Oars* the common Assayers have had in their proving *two Processes*, namely, upon the mild and flowing *Oars*, viz. the *Iron-streamy* and *bright Oars*) and such as are without *flints*: their *Process* was thus: They used to grind their *Oar* or *slick* very small, and have weighed a *Centner* of the *Fluss*, which they had prepared for the *Gold-Oars*, (as we shall discourse hereafter) and have mingled altogether, and did put it into a clean *Crucible*, and covered it with *Coals*, and have set it before the *Bellows*, and did blow about it, and when the *Fluss* was melted, then have they put fifteen *Centner* of clean *Lead* into it, and when it did begin to *slack*, then they take the *Crucible* out of the fire, and suffer it to cool, then beat the *Regulus* with the *slacks* out of the *Crucible*, and put it together upon a proof *Test*, in an *Assay Oven*, and have caused it to boil up, and *slack* again, as other *silver Oars*; and have stirr'd it about with a clean *Iron-hook*, and when it was well boyled up, they did let it cool; finally, they have beaten off the *slacks* from the *Work*, and upon a well *nealed Coppel* caused it to go off, but they have made their *fluss*, (for such proving) of one part of *Litarge*, and one part of *Antimony* well ground together and melted them, and when they did intend to use

it

it with such *Oars* (as were not *Iron-streamy Oars*) they added a little *filings* of *Iron*, that the *fluffs* might have something to *devour* and not hurt the *Silver* and *Gold*.

But the *flinty Oars* and *slick* which are harsh and un-flowing they have assayed according to the former way; only they have first *roasted* it, and some do quench it in the roasting with *Urine*, or with a particular prepared *Lye*, thinking thereby to obtain the more: But for my part, I do not esteem such *Processes*, because no more (by such *Labour*) can be brought out by it, than by the following *Method*, which I esteem more necessary; and through which the *Proof* may be accomplish'd cleaner, and in a shorter time: yet, because the abovesaid *Labour* was by the *Ancients* in use, therefore I do leave it according to its esteem with others.

The other proving is done thus, take the *Gold-Oar* or *slick*; either *flinty*, *raw*, or *deft*, as it happens, and grind it small: Of this weigh a *Centner* with thy *Proof-weight*, and put to it fifteen *Centners* of *granulated Lead*, and mingle them together in an *Assay-Test*, then put to it a *Centner* of small grounded *Lead-Glass*, and set it in a warm *Assay-oven*, make it first hot so long untill the *Lead* beginneth to drive, and the *Oar* to rise, then let it cool again, that the *Oar* may *roast* over the *Lead*, and rise no more, then cause it be hot again, so will it *slack* very clean, then stir it about with an *iron Hook*, and let it stand a little longer, when 'tis enough, then take the *Test* out of the *Assay-Oven*, let it cool, and beat the work clean off from the *slacks*, and let it go off upon a *Copel*; when this is done, then draw up the *Grain* against the *Lead-grain*, and as much as it is heavier, so much doth the *Oar* or *slick* contain of *Gold*, or *Gold* and *Silver*, which thou maist know by this that when the *Grain* is very white, then put it in a separating-Glass, to

CHAP.  
VIII.

Section.  
2.  
The flinty  
Gold Oars.

3.  
Another  
Proving.

CHAP. dissolve in *Aqua Fort.* but if the *Grain* is too rich in  
 VIII. *Gold*, so that the *Aqua Fort.* will not touch it, then add  
 to the *Grain* a little fine *Silver* which holdeth no *Gold*:  
 so that to one part of *Gold*, there may be three parts of  
*Silver* and cause this in a *Copel*, with pure *Lead*, to drive  
 together: After this, take that *Grain*, beat it flat with  
 an *hammer*, glow and dissolve it in *Aqua fortis*, as you  
 have been instructed before, then pour the *Aqua fortis*  
 off, and *dulcify* the *Gold* with warm water, put it out of  
 the *separating Glass* and glow it well, when this is done,  
 then draw it up with the *Proof Scales*, and you will see  
 how much a *Centner* of the *Oar* or *slick* doth contain of  
*Gold* and *Silver*, and by this *Proof* the *Affayer* may  
 know that all the *Gold* and *Silver* which is in an *Oar* is  
 certainly found, and hath not need of other *Circumstan-*  
*ces*, because the *Lead* doth take very willingly the *Gold*  
 and *Silver* to it self.

But how the *Gold* is to have its due *dissolution*, *dul-*  
*cification*, and what is else to be done with it, all this I  
 intend to declare hereafter more fully.

Hereby one may know that there is no need to take  
 any *Lead-glass* for such soft flowing or deft *Gold Oars*  
 or *Gold-Slicks*, but it may easily be boyld up, by gover-  
 ning the fire; one may also do the *flinty Gold Oars* in like  
 manner, only they are sooner and better boyld up when  
*Lead-Glass* is added.

Section.  
 4.  
 A fine Gold  
 Proof. Some *Affayers* have also used to grind the *Gold-slick-*  
*flint* and other *Gold Oars* very small, and weigh them off,  
 and put it in a *separating-Glass*, and pour into it good  
*strong Aqua fortis*, and they let it dissolve as much as  
 it will, afterwards letting the *Aqua fortis* be evaporated,  
 that it may all come hard in the *Glass*, they beat it out,  
 and boil it up in a *Test*, with *Lead*, and cause it to  
 go off upon the *Coppel*.

This proof I like well, and I judge, that if something  
 more

more of *Gold* may be obtained, that it must be done this way: only the great quantities must not be regulated according to this Method: Therefore every *Assayer* is to take heed with good Diligence, that he may order his *Assayes* thus, that he may alwayes find the *Contents* as near as he can, so that he may afterwards in melting great quantities, find the same according to the proportion.

CHAP.  
IX.

## CHAP. IX.

*How Gold in Lumps, Plates, Ingots or coyned Gold is to be assayed, and first of Touch-Needles.*



**B**ECAUSE in Touch Needles of *Gold*, there is often used much Deceit, especially by such who do buy *Gold* by the *Touch*, therefore to such Proving it is necessary to make true *Needles*, without Deceit, That one may not be over-reached by touching, so as when *Gold* is brought to a high colour by *Graduation*, that such a stroak upon the *Touch-needles* of eighteen *Carats*, with good *Crown Gold* may be made, and thereby may be judged.

Section.  
1.  
Deceit in  
Touch needles.

But first you are to be instructed that some sorts of *Gold* (that come from separating and have no *red*, but altogether *white*) cannot be touched upon a certainty with *Touch Needles* for *Gold*, on the contrary, such which have much *red* and little *white*, as the *Crown-Gold*, with *white Needles*, which are made for the separating, and *wash'd Gold* must not be touch'd, much less can the *Rhenish Gold*, which hath more *white* than *red*, be done by these now mentioned *Needles*, I will therefore first describe the *Needles* which are most in use, how they must

2.  
Of *Gold* and  
silver touch  
needles, cal-  
led *red* and  
*white*.

be

CHAP. be prepared and made, and afterwards the others also  
 X. with this Caution, that every Assayer may take good heed that he may so well order his *Goldstroak*, that he may not be esteem'd as one without understanding, and that he may not come to *Dammage*, because through false *Needles*, not only they who are unacquainted with the several sorts of *Gold*, but also such who handle them daily, are oftentimes deceived.

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 CHAP. X.

*How the white Touch Needles are to be made.*

Section.  
1.



O all *Touch Needles* for *Gold* you shall take pure and fine *Gold*, although such can be as little demonstrated as fine *Silver*, and I judge such *Gold* to be pure and fine, which is cast and diligently blowed off, and afterwards beaten thin, and by *Cement* and other ways cleansed (of which hereafter) now you are to weigh such *Gold* off: (for *Needles*) with a singular *Carat-weight*, which must be a little more than a common *Carat weight*, and to every one must be allowed, as followeth.

2. Weigh to the first *Needle* 24 *Carats* of fine *Gold*, which maketh the first *Needle*: to the *Second*, weigh 23 *Carats* and a half of fine *Gold*, and a half *Carat*, or six *Grains* of white fine *Silver*: to the *Third*, 23 *Carats* of fine *Gold*, and one *Carat* of white: to the *Fourth*, 22 *Carats* and a half of *Gold*, and one *Carat* and a half of *White*: to the *Fifth*, 22 *Carats* of *Gold*, and two *Carats* of *White*: to the *Sixth*, 21 *Carats* of *Gold*, and two *Carats* and a half of *White*: to the *Seventh*, 21 *Carats* of *Gold*, and three *Carats* of *White*: to the *Eight*,



*Eighth*, 20 Carats and a half of Gold, and three Carats CHAP. X.  
 and a half of White: to the *Ninth*, 20 Carats of  
 Gold, and four Carats of White: to the *Tenth*, 19  
 Carats and a half of Gold, and four Carats and a half  
 of White: to the *Eleventh*, 19 Carats of Gold, and  
 five Carats of White: to the *Twelfth*, 18 Carats and  
 a half of Gold, and five Carats and a half of White:  
 to the *Thirteenth*, 18 Carats of Gold, and six Carats  
 of White: to the *Fourteenth*, 17 Carats and an half  
 of Gold, and six Carats and an half of White: to the  
*Fifteenth*, 17 Carats of Gold, and seven Carats of  
 White: to the *Sixteenth*, 16 Carats and a half of Gold,  
 and seven Carats and an half of White: to the *Seven-*  
*teenth*, 16 Carats of Gold, and eight Carats of White: to  
 the *Eighteenth*, 15 Carats and an half of Gold, and eight  
 Carats and an half of White: to the *Nineteenth*, 15  
 Carats of Gold, and nine Carats of White: to the  
*Twentieth*, 14 Carats and an half of Gold, and nine Ca-  
 rats and an half of White: to the *One and Twentieth*,  
 14 Carats of Gold, and ten Carats of White: to the  
*Two and twentieth*, 13 Carats and a half of Gold, and  
 ten Carats and a half of White: to the *Three and Twen-*  
*tieth*, 13 carats of Gold, and 11 carats of White: to the  
*Four and Twentieth Needle*, 12 carats and an half of  
 Gold, and eleven carats and an half of White.

One must also according to this Method make the  
*Needles*: yet further, if one would do it well (but it  
 is not useful) to touch the meaner Gold under twelve  
 carats: or one might make the *Needles* from carat to  
 carat, so that the half carats are not brought in, for  
 they are very difficult to be discerned) but the *Nee-*  
*dles* will be fewer in number: this now is left to every  
 ones pleasure: and these white *Needles* are to be used  
 upon the parted and washed Gold, as abovesaid.

CHAP.  
XI.

## CHAP. XI.

How Touch-Needles are to be made and used for  
Crown-Gold.

Section:  
1.



**S**ROWN-Gold is not to be order'd like the former Additions: for the *Italian* Crowns have more *Red* than the *French* Crowns: so that it will be necessary to make to every sort of Gold particular *Needles*: for the *French* Crowns have almost the half part white, (or *Silver* addition) on the contrary, the *Italian* Crowns have their addition of one part *white* and two parts *red*. (though they are not all alike, for some part have addition almost the half part *white*, and some parts more *red* than *white*:) therefore I will here set down the Division upon two parts *red*, and one part *white*; for, if the one sort of Gold should be *whiter* than the *Needles* (hereafter mentioned) then the half white and half red are to be used.

Weigh then to the *first Needle*, 24 *carats* of fine gold, which maketh the *first Needle*: to the *Second*, 23 *carats* and an half of gold, and two *grains* of *white*, or fine *silver*, and four *grains* of *red*, that is, *pure boiled copper*: to the *Third*, 23 *carats* of gold, and four *grains* of *white*, and eight *grains* of *red*: to the *Fourth*, 22 *carats* and an half of gold, and six *grains* of *white*, and one *carat* of *red*: to the *Fifth*, 22 *carats* of gold, and eight *grains* of *white*, and one *carat*, and four *grains* of *red*: to the *Sixth*, 21 *carats* and a half of gold, and ten *grains* of *white*, and one *carat* and eight *grains* of *red*: to the *Seventh* 21 *carats* of gold, and one *carat* of *white*,  
and

and two *carats* of *red*: to the *Eighth*, 20 *carats* and a CHAP.  
 half of *gold*, and one *carat* and two *grains* of *white*, and XII.  
 two *carats* and four *grains* of *red*: to the *Ninth*, 20  
*carats* of *gold*, and one *carat* and four *grains* of *white*,  
 and two *carats* and eight *grains* of *red*: to the *Tenth* 19  
*carats* and a half of *gold*, and one *carat* and six *grains* of  
*white*, and three *carats* of *red*.

After this Method and Instruction one may divide  
 the *Needles* more or less, so as they may decrease  
 or increase from *carat* to *carat* as one pleases: These  
*Needles* are used not only upon the *Crown* or  
*Coin'd gold*, but also upon all other *Gold*, which is  
 of such *Allay*, or have in them the Addition, after  
 the above-mentioned Instructions.

## CHAP. XII.

*The Division of the Touch-Needles, when the Metal is half white, and half red.*



BECAUSE some *Crowns* are ordered  
 which have half *white* and half *red*,  
 which I esteem the finest in *Colour*, there-  
 fore weigh in the division to the first  
*Needle*, 24 *carats* of fine *Gold*, as al-  
 so in all the *Needles*, the highest best or  
 first *Needle* shall be fine *Gold*: to the  
*Second Needle*, 23 *carats* and an half of *gold*, three *grains*  
 of *white*, and three *grains* of *red*: to the *Third Needle*  
 23 *carats* of *gold*, six *grains* of *white*, and six *grains* of  
*red*: to the *Fourth*, 22 *carats* and an half of *Gold*, and  
 nine *grains* of *white*, and nine *grains* of *red*: to the  
*Fifth*, 22 *carats* of *gold*, one *carat* of *white*, and one  
*carat*

Section.

I.

The fairest  
 Crowns in  
 Colour.

CHAP. XII. *carat of red: to the sixth, 21 carats and a half of gold, and one carat and three grains of white, and one carat and three grains of red: to the Seventh, 21 carats of gold, and one carat and six grains of white, and one carat and six grains of red: to the Eighth, 20 carats and an half of gold, and one carat nine grains of white, & one carat nine grains of red: to the Ninth, 20 carats of gold, two carats of white, and two carats of red: to the Tenth, 19 carats and a half of gold, and two carats and three grains of white, and two carats and three grains of red: to the Eleventh, 19 carats of gold, and two carats six grains of white, and two carats six grains of red: to the Twelveth, 18 carats & a half of gold, and two carats and nine grains of white, and two carats & nine grains of red: to the Thirteenth 18 carats of gold, three carats of white, and three carats of red: to the Fourteenth, 17 carats and a half of gold, and three carats and three grains of white, and three carats and three grains of red: to the Fifteenth, 17 carats of gold, and 3 carats and six grains of white, and three carats and six grains of red: to the Sixteenth, 16 carats and a half of gold, and three carats and nine grains of white, and three carats and nine grains of red: to the Seventeenth, 16 carats of gold, and three carats of white, and three carats of red: to the Eighteenth, 15 carats and an half of gold, and four carats, and three grains of white, and four carats, and three grains of red.*

Section.  
2.

After this Method you may divide the *Needles* more or less, or to increase or decrease from *carat to carat*, as you were instructed before.

## CHAP. XIII.

*How Touch-needles are to be made for Rhenish Gold, in which there is two parts white, and one part red.*



ALTHOUGH some of the *Rhenish Gold* hath also the addition of *half white* and *half red*, to which the *Needles* before set down are to be used: Nevertheless if the Addition be *two parts white*, and *one part red*, upon such you shall divide the *Needles* thus,

*The Division of Metals for Needles.*

To the first *Needle* weigh 24 *Carats* of fine *Gold*, which maketh the *first Needle*: to the *Second needle*, 23 *Carats* and a half of fine *Gold*, and four *Grains* of *white*, and two *grains* of *red*: to the *Third*, 23 *Carats* of *Gold*, and eight *grains* of *white*, and four *grains* of *red*: to the *Fourth*, 22 *Carats* and a half of *Gold*, one *Carat* of *white*, & six *grains* of *red*: to the *Fifth*, 22 *Carats* of *Gold*, one *Carat* and four *grains* of *White*, and 8 *grains* of *red*: to the *Sixt*, 21 *Carats* and a half of *Gold*, and one *Carat* and eight *grains* of *White*, and ten *grains* of *red*: to the *Seventh*, 21 *Carats* of *Gold*, and two *Carats* of *White*, and two *Carats* of *red*: to the *Eight*, 21 *Carats* and a half of *Gold*, and two *Carats* and four *grains* of *white*, and one *carat* and two *grains* of *red*: to the *Ninth*, 20 *carats* of *gold*, and two *carats* and eight *grains* of *white*, and one *carat* and four *grains* of *red*: to the *Tenth*, 19 *carats* and a half of *gold*, and three *carats* of *white*, and one *carat* and six *grains* of *red*: to the *Eleventh*, 19 *carats* of *gold*, and three *carats* four *grains* of *white*, and one *carat* and eight *grains* of *red*: to the *Twelfth*, eighteen *carats* and an half of *gold*,

M m

three

CHAP. XIII. three *carats*, and eight *grains* of *white*, and one *ca-*  
*rat* and sixteen *grains* of *red*: to the *Thirteenth*, eight-  
 teen *carats* of *gold*, and four *carats* of *white*, and two  
*carats* of *red*: to the *Fourteenth*, 17 and an half *ca-*  
*rats* of *Gold*, and and four *carats* and four *grains* of  
*white*, and two *grains* of *red*: to the *Fifteenth*, 17  
*carats* of *gold*, and four *carats* and 8 *grains* of *white*,  
 and two *carats* and four *grains* of *red*: to the *Six-*  
*teenth* 16 *carats* and a half of *Gold*, and five *carats* of  
*white*, and two *carats* and six *grains* of *red*: to the  
*Seventeenth*, 16 *carats* of *gold*, and five *carats* and four  
*grains* of *white*, and two *carats* and eight *grains* of *red*:  
 to the *Eighteenth*, 15 *carats* and an half of *gold*, and  
 five *carats* and eight *grains* of *white*, and two *carats*  
 and ten *grains* of *red*: to the *Nineteenth*, 15 *carats*  
 of *gold*, and 6 *carats* of *white*, and three *carats* of *red*:  
 to the *Twentieth*, 14 *carats* and a half of *gold*, six *ca-*  
*rats* and four *grains* of *white*, and three *carats* and two  
*grains* of *red*:

Although now the *Rhenish Gold* useth not to be of so  
 small a content, nevertheless the *Needles* are thus to be  
 made for the *Allay* or additions sake, that one may by  
 the *Touch* know the *Mean-Gold* by it, and judge of  
 the nearest Content.

Section.

2.

*Needles of*  
*Copper:*

One may also according to this manner dress or or-  
 der some few *Needles* with all *red* or *Copper*, for some  
*Gold*s especially they which are rich among the *Coynes*,  
 (the *Hungarians* having all *red* :) But when one would  
 make *Touch-Needles* upon a certain Content of *gold*,  
 which with the addition of the *Allay* should be other-  
 wise than they which are shewn before, then they  
 may be divided after the above-mentioned instruction:  
 which you are to understand thus: Let the Contents  
 of *gold* be with *Allay* or *addition*, as it will, yet order  
 thy *Touch-Needles* thus, That alwayes *gold* and the *ad-*  
*dition*

dition may make together a full *Mark*, as is to be seen in the above-mentioned instruction of the *Needles*.

When you have divided the *Needles* with diligence, then let the division of every one severally be put in a little *Crucible* with a little *Borax*, flow it together and when it is flowed put it quickly out, for the sooner the division of the composed *Metals* flow together and come out of the fire, the better it is: Some let it go together in a *Charcoal* fire, but the *Divisions* remain not alwayes deſt of it, and ſometimes the *Coals* break, and by that division does come to nothing, therefore 'tis better to let it flow together in a ſmall *Crucible*, whereby there will not be ſo much care of running through.

When the *Divisions* are caſt together, then beat them every one ſeverally into *Lengths*, and form them according to thy pleaſure, beat and cut alſo upon the *Needles* the *Figures* what every one containeth of fine *Gold* and *Allay*, that one may ſee how many *carats* and *grains* of fine *Gold*, every *Needle* hath, that in the *Touch* there may be no *Miſtake*.

If one hath a mind he may ſoder together the ordered *Needles* upon *copper* or *ſilver* pieces, that only the ends may be *Golden* divided *Needles*, as alſo commonly of the *Gold-Touch*, and uſually *Needles* are made ſo, elſe they would come to much *Mony*, as may be ſeen by the following *Sculpture*.

But the *Gold-Smiths* take not ſo much *Pains*, nor are at ſo large *Expences*, but cut a piece of a *Ducate* and of a *Crown*, and of a *Rheniſh Gilder*, and ſoder every on *Copper* piece, after this they touch their *Gold*: And by this they can very well ſee whether the *Gold* have its right *Content* either of *Duccats*, *Crowns*, or *Rheniſh Gold*, but if there be a different *Content*, then they cannot know how much properly the *Content* is leſs.

CHAP.  
XIII.

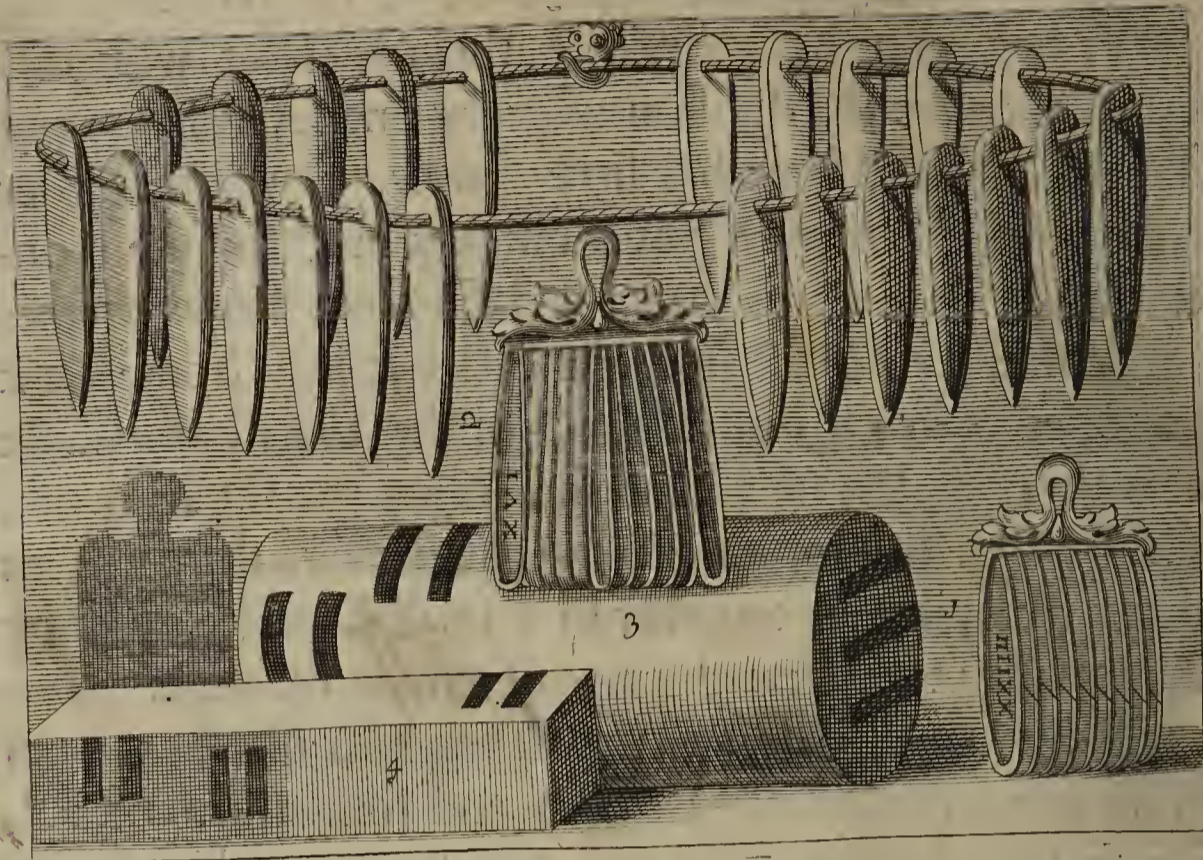
Section.

The 3.  
Division to caſt together.

The 4.  
Needles to be beaten into lengths.

The 5.  
The Touch  
Needles of  
the Common  
Gold Smiths.

Sculpture.



Deciphered.

1. *The Proportions of Touch Needles for Gold.*
2. *The Ingot to be compared with those Touch-Needles.*
3. *As also by the Touch-stone.*

## CHAP. XIV.

*How the Touch Needles are to be used.*

Section.  
1.  
Touchstones



**WHEN** then the *Touch-needles* are prepared with diligence, and one would use them, there is need of a good *Touch-stone* upon which the *Gold* is to be touched, of such are found some part which are grey and pale green, but the black ones are the best, although the same be not all good, especially, if they are either too hard or too weak. The *weak* ones have this property, that upon them no *Gold* doth touch bright,



bright, but the *Gold* doth only grind on it, and becometh in the aspect *weak* and ruffe, also the *Hungarish* or other weak *Gold* will not touch it self right upon *Touch-stones* which are too hard, for the *Gold* doth run over it, that the stroak is not very well to be seen; and that *Touch-stone* is not good which doth not touch the *Gold*, of what Contents soeyer it be, with a fine good and strong stroak, that it be bright upon it, and also the *Touch-needles* as long untill the same stroak be like the *Gold-stroak* in the colour, and as high: then you have very nigh the Content of the *Gold*: only, as I have given an account above, Observe well, whether the *Gold* be high-grain'd; viz. whether it hath much *Copper* added, or much *white*, which is called *Pale Gold*, according to this, use the *Needles*, which every one doth not understand, and therefore he must have the Knowledge of the right stroak from great *Practice*. But as to the *hard Gold*, they do not give a right stroak, but they do touch all of a smaller content than they have in fine *Gold*, therefore such stroaks are to be judg'd *false* and uncertain.

CHAP.

XV.

Section:

Ginnys.

2.  
Concerning  
hard and  
bricke Gold.

## CHAP. XV.

How the Gold is to be proved by Aqua fortis.

**I**F you have Pieces of *Gold* either in *Plates* or *Ingotts*, and wouldst assay them, then first cut *Pieces* or *Plates* above; at one end of it, and below at the other end, and beat the *Bits* thin that you may weigh so much as you have necessity to use for a tryal, but if it is a cast *Ingot*, then

1.  
To cut  
pieces for  
Treal.

N n

beat

CHAP. beat it thin only at one end, and weigh of it for thy  
 XV. Tryal.

Section.  
 2.  
 The Carat  
 weight must  
 be small.

To such a Tryal of *Gold* and *Gold-Gilders*, you must have a particular *Carat-weight* fitted for it, and it must be small because of the *Silver-cut*, otherwise the *Ballance* cannot carry the *Cut* (concerning which shall be treated of hereafter) the dividing of the *Carat* weight is as followeth.

*Division of the Carat-weight.*

24 Carats is one *Mark*.

12 Carats

6 Carats

3 Carats

2 Carats

1 Carat

6 Grains is half a *Carat*.

3 Grains

2 Grains

1 Grain

$\frac{1}{2}$  Grain

$\frac{1}{4}$  Grain

$\frac{1}{4}$  Grain

If you would prove the *Gold*, see if it be of a rich or poor Content, and would also certainly judge how much a *Mark* of it hath of *fine Gold*, then you must know first (and before the nearest Content of the *Gold* according to which you are to make your *Tryal*, as shall follow.) That for such contents you shall have two sorts of wayes to inform your self, First, by the *Touch* with the before made *Golden Touch-Needles*;) Secondly, One may make a nearer Trial of the *Gold*, for, although the Proof do not remain whole in the *Aqua fort.* yet you may see very near what the *Gold* doth hold

hold, Therefore it is best to use the *Assay-proof* upon CHAP. XV. it, by which one may also find, what the *Gold* containeth both in *white* or *fine Silver*. When now you have found by these waies the nearest content of the *Gold*, Assay proof. then make the cut of *fine Silver* (which must be without *Gold*;) take then the *Gold* and beat it with a *Hammer* upon an *Anvil* fine and thin, and make thy cut so, that the *white* or *Silver*, which is already with the *Gold*) may be counted with the *Tryal* or *fourth* part (for it must contain three times as much *Silver* as of *fine Gold*.) To comprehend this the better, the following Example shall demonstrate it, which I have found by the tryed Proof, that of the *Gold* which containeth 14 *Carats*, 8 *grains* of *fine Gold*, and 7 *Carats*, and four *grains* of *white*; I weigh it with the small *carat* weight to two alike *half-Marks*, then there will be in every *half Mark* 7 *carats*, and four *grains* of *Gold*, and 3 *Carats* and eight *grains* of *white*, to which I add three times the weight of *fine Silver* as the *gold* containeth of *fine gold*; this is my Proportion. Now I do multiply the seven *carats* and four *grains* (which containeth the *half Mark*) of *fine gold*, with three, and there will come 22 *carats* of *white* or *Silver* to the Addition or to the *Cut*: from this I reckon, That of three *carats*, and eight *grains* of *white* there will be as much as the *half Mark* had of *Silver* with it before, so there will remain 18 *carats*, and 4 *grains*, and thus much *fine Silver* you must add in an *half Mark*.

<sup>4.</sup>  
To make the  
Carat.

As this *Silver* or *Cut* and the *half weighed Mark* do make together 30 *carats*, and 4 *grains*, so much also must be the *inweighed gold*, of the other *half Mark* cut. Put every one of these with its *Cut* upon a well *nealed Copel*, and add nine weights of pure *Lead* into it, let it go off together, and see whither the *grains* come alike, then lay one of the *grains* in the *Scale*, and as much

as

<sup>5.</sup>  
The Tryal  
of it.

CHAP. as it now weigheth less than thirty *carats* and four *grains*,  
 XV. so much containeth a half *Mark* of *Gold - Red - Copper*,  
 Section. but to the *fine Silver* because it looseth upon the *Copel*,  
 if it goeth off upon it with *Lead* as much as the *Lead*  
 hath carryed away, may by a *grain weight* be account-  
 ed; for, understand it thus; In case every *grain*  
 did weigh after it was gone, of 29 *carats*, and 4 *grains*:  
 also a *grain* wast of *fine silver*, there would be wasted  
 one *Carat* upon the *half Mark*, then there will come  
 upon the whole *Mark* two *carats*; thus much *Copper*  
 (or *red*) containeth a *Mark* of mixt *Gold*.

6. If the *grains* are diligently drawn and weighed, then  
 To beat the little Rolls. beat out of every *grain* a fine and clean piece or *Roll*,  
 not too thin, and glow it often that it may not be *shive-ry*,  
 and that nothing may go off; at the last glow the  
 little *Roll*, and roll it gently over, that you may see  
 whether by the often glowing and beating somewhat be  
 come off: When now the *Rolls* are clean prepared,  
 glow them once more, and if they from the glow-  
 ing and rolling be come hard, let such things be men-  
 ded.

7. But the glowing must be done in a golden little half  
 Dissolving. Pipkin made on purpose, that nothing unclean may come  
 in it, put then the *Rolls* together in a little *separating*  
*Glass*, put to it near so much *Aqua fortis* made for *Gold-*  
*proofs*, that it may go an half finger broad over the lit-  
 tle *Rolls*, stop the *Separating Glass* above with a hard  
 twisted paper, that no vapors may go out, and put it  
 thus into a little *Vessel* of *Iron* or *brass* made on purpose,  
 over a few live *Coals*, that the *Aqua fort.* may begin  
 to work, so will the *separating-Glass* become brown,  
 but let it not work too much or too fast, yet take it a  
 little while from the *fire*, and then put it on again, un-  
 till the *Aqua fortis* hath done its working, and the *Glass*  
 become white again: Then put off the *Aqua fortis*  
 again

again and put fresh *Aqua fortis* upon it, set it again with the Vessel over the fire, and let it work: this is done, because if the first *Aqua fort.* were grown too weak, and had lost somewhat of *Silver* by the *Rolls*, that the other *Aqua fort.* might touch it again, and make it clean. Take notice also, That you may cause the last *Aqua fort.* to work in great *Bubbles*, that the *Roles* may become very clean, and put in the second *Aqua fort.* which hath not been used, for it hath its strength as before.

Then put clean sweet warm water upon the little *Rolls*, (*Rain Water* is the best for it) let it stand a little, and put more warm, or rain *Water*, upon it again, and set the *Glasses* with the *Rolls* over a coal fire, let it boil and work in great *Bubbles*, then take it off, and casting the water again away, this do three times with warm or rain water, that the *silvery Aqua fort.* which did hang about the little *Rolls* be *dulcified*, then is it enough: When the little *Rolls* are thus clean and sweet, then put them out very gently, with the last sweet water in a glaz'd pot or glass bottle, and pour the water off from it, and take the *Golden Rolls* with clean *Pincers* out of the Pot, and put them in a clean cloth to suck the rest of the water into it, and the *Rolls* will look very fine and brown.

Then put them into the *Golden pott*, and after, put them into an *Assay-Oven*, but not in an exstream heating, and glow them well and they will become as fine as a *pure Gold*: When this is done, Take the two little *Rolls*, weigh them one against the other, and if they are alike in weight, then have you proved them right: next, put them together in a *weigh-scale*, and weigh them with the *Carat-weight*, and how much they do weigh, so much containeth the *Mark* (of the mixt *Gold*) in fine *Gold*: this only is to be observed, That the weight of the *Wa-*

O o

ter,

CHAP.  
XV.Section  
8.  
To sweeten  
or dulcify.9.  
To Neal the  
little Gold  
Rolls.

CHAP. XV. ter, (as much as the Water hath left after it with the Golden Rolls) must be subtracted always in the Weight from such Content: But how much there will be to subtract you must search with a singular Proof, with which you use to prove the *Aqua fort.* but when you have once proved the *Aqua fort.* then you have no need to prove it any more, but may keep it for use: yet 'tis commonly found that upon a *Mark* of fine Gold, as from 24 *carats* you must subtract one and a half, sometimes two *grains* for the weight of the water, and so you must subtract according to the Example of the before mentioned Proof, as upon 14 *carats*, and 9 *grains*, as much as the Golden Roll of one *grain*, did weigh, then there will remain 14 *carats* and 8 *grains* of fine gold, for in the *gold proof*, in many places, one useth not to give in, in buying, a half *grain*, but in the *coin-works* they use all wayes to count, and give in the half *grain*: If then the little Rolls contain in fine gold 14 *carats* and eight *grains*, then a mixt *mark* of Gold will contain 7 *carats* and four *grains* of white or fine silver subtracted.

Now, the Gold of 24 *carats* and 8 *grains* of the whole cut, and 24 *carats* of Gold & 44 *Carats* of silver, you shall finde (as I have said) that the Contents will be a mixt *mark*, 14 *carats* 8 *grains* of fine gold, and 7 *carats*, and 4 *grains* of white, and two *carats* of red, and these three Contents will make together a full *Mark*.

Section.  
10.  
Coined  
Gold.

After this manner and method are to be proved all other *Golds*, likewise the *coyned Gold*, and one needeth not the *Assay-Proof*, in the *coined Gold*, if one knoweth the nearest Contents, but if one doth not know the Contents certain upon a *carat*, then an *Assay* of it must be made.

11.  
To make the  
true Carats.

Now I use this Method in my *Cut* (and commonly on the silver or *Cut*) to take two *carats* or somewhat

what less for a tryal which doth agree with the Multi-  
plication (as above-heard, of the three Contents,) and  
it is better to take two Carats of silver less than one too  
much, and so the Rolls will remain the firmer and more  
intire, and there is no fear though somewhat of the Rolls  
were lost or torn off.

You may also finde in a *Gold* (of which you intend  
to prove the *red* and *white*) that if you make the  
Assay-Proof, (as above demonstrated) then cut one  
*Mark* of the *Gold* more, and put it with its due of  
*Lead* without any other *Cut*) upon the *Coppels*, and let  
it go off with the *Try-proof*, then weigh the same *Grain*,  
and you will see what is gon off, and how much it comes  
out lighter, so much hath been *red* with it.

12.  
Another  
way to find  
red in Gold.

Thus you have the right and clear Instruction for  
*Gold Proofs*, and if you will follow it, you will  
do well, and thereby not be apt to err in your  
proofs.

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CHAP. XVI.

*How to prove the Aqua fort. and how much Gold  
it doth leave in the Proof.*



ALSO, if thou wilt prove an *Aqua fort.*  
how much is subtracted in the *Gold-  
Proof*, Take *Gold* which is cast divers  
times, through *Antimony*, and is  
brought to the highest: and make the  
proportion upon 24 *carats*, and weigh  
it also in two half *Marks* (as you have  
been instructed before) and multiply it by 3, then there  
will come upon every half *Mark* of fine *Gold* 36 *carats*  
of fine *Silver*, then put every half *Mark* of its propor-  
tion

1.  
The manner  
of Trying it.

CHAP. tion by it self, upon well Neal'd *Coppels*, let it go off to-  
 XVI. gether, weigh the grains off, and see whether they come  
 alike, and beat them in slender *Rolls*, and put them in-  
 to separating *Glasses*, and put upon them so much *A-*  
*qua fort.* as one doth use to take to a *Gold-proof*, as hath  
 been shewn before in the *Gold proof*: then place it with  
 an iron *Treyet* over a little *Coal-fire*: Let it dissolve,  
 and put upon it the Second time fresh *Aqua fort.* set it  
 over again; when now it is right, and well dissolved,  
 pour the *Aqua fort.* on it, and make the *Rolls* with warm  
 vvater very clean, and dry them, and glovv them in a  
 little melting pot for *Gold*, and they vvill become fine,  
 then weigh them one against the other, and if the *Rolls*  
 be alike then the *Proof* is right; then lay them together,  
 and against it thy whole *mark*: (after you have weigh-  
 ed it) and as the *Golden Rolls* do come out heavier, so  
 much is to be substracted in the *Gold-proof* upon this one  
*Mark* of fine *Gold*.

Section.

2.  
Another  
way.

Take this for an Example: I have weighed in two  
*half Marks* upon one *Mark* of fine *Gold*, and have par-  
 ted it vvith the *Aqua fort.* (as above is mentioned)  
 and after the dissolving, dulcifying and glowing, then the  
 two little *Rolls* have weighed one *Mark* or 24 *carats*  
 and one *grain* and a half, so that the *Aqua fort.* hath left  
 behind two *grains*, in the *Proof*, thus much is to be  
 substracted in this *Aqua fort.* upon 42 *carats*.

3.  
What the  
Remainder  
is.

Know also that such as is kept back in the *Aqua fort.*  
 is nothing else but *silver* which the *Aqua fort.* could not  
 draw out so clean, by which the *Gold* doth not become  
 so very clean and fine, which is to be seen. If one let-  
 teth the *Golden* part go off with a little clean *Lead* upon  
 a *Coppel*, to see how they become smaller or retain their  
 weights. But if the *Aqua fort.* do leave its strength or  
 spirits with the *Gold*, (as some do think) then the same  
 could not remain nor consist upon the *Coppels*.

Out



Out of which may be concluded, That by *Aqua fort.* fine Gold is made: But this is sure, That a good and well purified *Aqua fort.* bringeth the Gold in parting (especially if the *Gold Calx* (as shall follow) hath been cleanly dulcified) to 23 *Carats* and 11 *Grains*. But it is not yet quite *fine Gold*, for the remainder with the Gold is nothing else (as is said before) than *Silver*: (as well in the parting the Gold, as in the Proof) else one may drive away what is left with the Bellows, and make it clean.

But if you have no *fine Gold*, to the Proof of the *Aqua fort.* then take *Hungarish Gold*, whose Content you know certainly, and make of the same Content the Divisions and Proportions, then you may find what is to be left behind of the *Aqua fort.* and how much is subtracted of it: But the *Gold* which is cast through *Antimony* (as is before mentioned) is for such use much surer and better: And know, That the same *Aqua fort.* after the Distilling must be purified and settled, before you do prove or use it to the *Gold-Proof*, of which afterwards an Instruction shall follow.

To all such proving you must have clean *separating Glasses, Tunnels* and little *glass Pots* for *Gold* to sweeten in, these are to be made of good *Venetian Glass*, and the brighter, whiter and clearer they are, the better it is, that the proofs may well be seen in them.

But the *Iron* or *Brazen* Instrument, upon which the little separating Glass must stand, is to be made four footed, that it may stand fast, and also with a little handle, by which it may be taken off, likewise another little foot or instrument of *Copper* or *Iron*, which must be flat, upon which is to be set the *Golden little Pots* (if one will have it set in the *proof-Oven* for the out-glowing) because this Proof is the finest, most glorious and lovely; therefore all

P p

things

CHAP.  
XVI.Section.  
4.  
Rules for it.5.  
Separating  
Glass, and  
other Glass  
Instruments6.  
An Instru-  
ment for the  
Separating  
glass.

CHAP. things pertaining to it must be made and prepared with XVII all diligence and cleanliness.

## CHAP. XVII.

*How Silver is to be proved for Gold.*

Section.

1.  
First Tryal.



2.  
To dulcify  
it.

**W**HAT I may not mix the Proving of Metals together, but give to every proof its due, and to write of every one apart, how it must be done: Know then if one would prove a *goldish silver* upon *Gold*, it must first be proved upon *fine Silver*, that one may find the right Content, both of the *fine Silver* and also of the *fine Gold*: Therefore when it is proved upon the *fine* (as I have taught in the *Silver proof*) then take the same *proof Grains*, beat them thin, glow them, and weigh a *Mark* of it with thy *Penny-weight*, and dissolve the *Silver* in a little separating *glass* in *Aqua fort.* then there will remain a brown *Gold-Calx*: pour off the *Aqua fort.* very gently, then take warm sweet water (as you have done before in the *Gold Proof*) and put it upon the *Gold-Calx*, and let it boil over the *Coal-fire* in a little *Culbe* or bottle: now when the *Gold Calx* hath settled it self again, then drain the water off, and put upon the *Gold Calx* two or three warm waters more, that thus the *silvery* water may be clean taken off from the *Gold Calx*, then put the *Gold Calx*, clean out of the *Culbe*, into a *glass pott*, that nothing may remain, then drain the water very clean off from it, and bring the *Gold Calx* in the *golden little Pot* clean together, and if there be wetness about the *Gold-Calx*, then press it with a clean little cloth where 'tis made moist, and gently on the

the end of one side, that the *wetness* may be suck'd in (only touch not the *Gold Calx* with the Cloth.)

When this is done, then set the little *golden Pot* upon the *Trevet* in the *Assay Oven*, but not suddenly (that the *Gold* may not leap, and the proof become false) and glow out the *Gold calx*, so will it become fair, then put it again out of the *golden little Pot* into the inward Scale of the *Proof-Ballance*, and see how much it weighs according to the divided *Penny-weight*, with which you have weighed it, so you will have the Content; now how much a *Mark* of *Silver* containeth, I put this as an Example, for I have proved, That a *Goldish silver* or *grain'd Gold*, of this mixt *Mark*) hath contained 14 *lots* and a *dram* of fine *Silver*, and such fine *Silver* hath in a *dram* a *penny-weight* of *Gold*, then the Content in the *Goldish Silver* upon a *Mark* doth signify that it doth contain 13 *lots*, 3 *drams*, and three *peny weight* of fine *silver*, and one *dram* and one *peny weight* of *Gold*.

Likewise in this manner one may also prove the fine *Gold* which is come from *grained Silver*, if one doth weigh a *Mark* of it, and dissolve it, and if the fine *Mark* in such a proof do contain one *dram*, one *peny-weight*, and one *Heller* of *Gold*, and is the Contents: and if a *Mark* of the *grained Silver* containeth 14 *lots* one *dram* be reckoned upon fine *Silver*, then the *Mark* will signify one *dram*, one *peny*, one *beller* of *Gold*, and of such proof it is counted, that by it the *Gold* is found a little less than the former, but I leave it to every ones pleasure to try and judge.

Some *Assayers* have this Method, when they would prove a *goldish grain'd Oar* for *Silver* and *Gold*, then they weigh the *grain'd Metal* with their *penny weight*, and prove it upon fine *Silver*, (as 'tis usual) and they weigh in a grain such *grain'd Metal* after the mentioned weight (as at first) and dissolve it raw in *Aqua fort.* and

CHAP.  
XVII

Section.

3.  
To glow.

4.  
A Second  
Tryal.

5.  
A third  
way.

CHAP. and as much then as they do find in *Gold*, they sub-  
 XVI. tract it from the *fine-Silver*, and this they count for the  
 right proof to prove *Silver* upon *Gold*.

Section.  
 6.  
 Difference  
 of the Proof.

But that one may know that this their *Proof* is false and unjust, although somewhat more of *Gold* is to be found by it, therefore I will shew some Reasons why the same *Gold* is not so high in Fineness as the *Gold* which is separated out of the *Proof* of the *fine Silver* by *Aqua fort.*

First, although the *Copper* doth dissolve, yet the green *Coppery water* sets it self rather on the *Gold* than on the *silvery water*, and then the *Copper* which hath set it self cannot be brought off again so clean from the *Gold*, as from the tender *silvery-water*.

Secondly, *Gold* cometh higher out of the separation than when the *silver* is *Coppery*, upon which the *Aqua fort.* doth not work so easily, as on the *fine Silver*; Therefore no *Separator* of *Gold* doth take upon him to separate such *Silver* after such proof, but all the *Silvers* which he separates in *Aqua fort.* must first be burnt upon a *Test*.

7.  
 A Singular  
 Dissolving.

Thirdly, Although the first Process to prove the *Goldish Silver* upon *Gold* is the common way, and also the right Proof, by which the true Content is to be found. Nevertheless, I must further mention a *singular proof* (which is found upon such *goldish silver* and *grain'd Work*) by which, in the dissolution the little grains or small cut pieces of *Silver* will remain whole in the *Aqua fort.* (of what light Contents soever they be of *Gold*) and how small and subtil soever the grains be: also that one may number all the little grains of *Gold* after the number of the little pieces of *Silver*, how many there be laid in the *Aqua fort.* and no splitting will go off from it (as in the other proofs) yet if the grains should be weighed in, (also raw) the *Gold* will remain the better

ter whole, but this proving is to be done thus, when CHAP.  
XVIII  
 you have weighed off the *Silver* put upon it a very weak *Aqua fort.* which the *Silver* cannot well touch, and put it in a *Culbe* to dissolve over a little Coal - fire (as is usual) and let it be very hot, that the *Aqua fort.* may work with great Bubbles, and almost boyl over; this dissolution do, so long until thy inweighed *Silver* be almost dissolved, but that it may have the better help, put (if the *Silver* be dissolved) a little more than half of new and a somewhat stronger *Aqua fort.* into the *Culbe*, and the *Silver* will dissolve it self clean out, and will split no more, although the second time, there be put to it, the stronger *Aqua fort.*) but what it doth will be done at first.

This is a fine way through which the Gold remaineth together in *grains* close, but 'twill have somewhat more time than the other common proof: there are also other wayes to such proofs, as follows.

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## CHAP. XVIII.

*To prove Goldish-Silver by the Water-weight.*



**S** MUST further signify, That the old *Artists* have also proved the *Silvers* through common *flowing Water*, and known in the *Weight*, whether they have been rich or poor with *Gold*, This their *Invention*, because it proceedeth from natural *Reason*, doth please me, and is an inductive *Meditation* to many other serviceable things: Now the *Water-weighting* with the *Silver* is done thus, Take a *Ballance*, and put in one of the *scales*

Section.  
I.  
*First Way.*

Qq

the

CHAP. XVIII the *Goldish-silver*, and in the other *Scale* so much *Silver*, (which containeth no *Gold*) as that they may be equal weight, then let down both *Scales* just together into a *Vessel* full of clean water, so you shall find and see clearly that that *Silver* which is *Goldish* shall have in the water greater weight, but not so much as the *Silver* which hath *Gold* with it. The Reason of this Difference, is because the *Gold* in a like greatness excelleth all other Metals in weight, and is the heaviest Metal; Therefore such (as every one himself may judge) cannot swim so easily in the water, but must much sooner sink down on the ground, than they which are lighter: as the like is to be seen in the *Lead*, which goeth much before *Tin* and other Metals in the *Water*.

Section.  
2.  
How the  
Gold is to be  
found by  
the Water-  
weighing.

But that I may give the Reader to understand, That 'tis possibly by such *Water-weighing* to reckon how much may properly be in the *Silver*, therefore know that such (in my thoughts) may be done and found out in this following manner.

First, Take *fine grain'd Silver* which is without *Gold*, lay to it good pure *Gold*, put it in one of the *weigh-scales*, and in the other *Scale* lay *fine grain'd silver* also, so that it standeth just even: then sink both together in the water, and so much as the *Silver* goeth before with the *Gold*, so much you must supply with good *Gold* to the *weigh-Scale* in the water, then take the *Ballance* out of the water again, dry it well, and weigh it, and take so much from the *Silver* as the *Gold* hath drawn to it in the water, until the *Ballance* standeth even in *Æquilibrio*, then sink it in the *Water* again, and supply again the difference with good *Gold*, and then take off from the *Silver*; this do as long until both *weigh-scales* stand just (both within and out of the water) then you shall find that in one *scale* will lye so much *Gold* as in the other: and by this way (if you do  
it

it carefully) you may also prove in weighing a *goldish silver*, whose content you did not know.

Secondly, The *water-weighing* may also be done by *Arithmetical Proportions*, to which the Demonstrations will be serviceable, but they are not to every one known, namely thus, That if the *Gold* (as I have tryed it) weigheth against the *silver* in a like quantity 405 *Markes*, and 8 *Loths*, and the *fine silver* also the like quantity with the *Gold* two hundred twenty sev'n *Markes*, 4 *Loths*; this observe well, Then take the *silver* vvhich contains *Gold*, lay it in one of the *weight-scales*, and weigh it against the *Weights* which are made of pure *silver*, that you may know the weight to be proper, then sink them together into the water: now, as much as it doth go for the *Goldish silver*, so much you must supply of with the *silver weights*, then make an account and observe the *Proportions* how the *Gold* and *Silver* stand together, as you have been instructed before, and I doubt not but you may come to a right proof by this Example.

CHAP.  
XVIII

Section.

3.  
*Arithmetick.*

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CHAP. XIX.

To find without such water-Proof, whether Silver contains Gold.



BECAUSE the Metals have divers Quantities of like greatness, one against the other (as has been spoken of the *Gold* and *silver*) if then you would know and finde the difference of the mixture in the *Goldish silvers* you must draw the *Gold* through an *Iron plate* wherein an hole is made, into which a thin and subtil wyer is to be put, and do the

1.  
*First Way.*

CHAP. XIX. the good *silver* also through the same hole, then cut a piece of both, equally in one length as near as possible, and weigh one against the other with a *Proof-weight*, upon a quick *Ballance*, and so you will soon finde the difference betwixt the *Gold* and *Silver*. Now, if you have a *Goldish-silver*, and do draw it through the mentioned *hole*, and doth take the right length of it, like the aforesaid former *Wyer*, and doth weigh it likewise upon the *proof-Ballance* against the *silver-Wyer*, then you will finde a difference in the weight, out of vvhich you may count the weight of the *Gold* (as much as is in the wyers which you have weighed) then also weigh such with the *proof-weight*, how much it weigheth, and you may compute (after this thy *Account*) how much *Gold* is in the whole weight of the *Goldish-silver*.

After this manner all other *Metals* may also be proved and accounted, because they have one against the other divers *Quantities* in like *Greatness*: likewise in the *coyn'd Money*, if it be drawn to a *Wyer* (in the same thickness with the *Wyers* before mentioned) you may find in it the *Copper* and fine *silver* by this *Rule*.

Section:  
2.  
The second  
Way.

Also, this I would not leave unmentioned, as an *Instruction* for further *Consideration*, and it is necessary to be known, That there is a difference in weight, betwixt *Tin* and *Lead*, if they be mixed together, as also in other *Metals*, which I have found in my diligent searching; For, one *Copper* against another, and one *Tin* against another, hath a difference also in the weight, else I would have proceeded further and surer with such reckoning.

CHAP.





Deciphered

1. How the Assayer stands before the Assay-Oven to prove Metals.
2. The Iron on which the Proof is to be cast.
3. A wooden Instrument to see through into the fire to prevent hurt to the Eyes.

R r

4. A

- CHAP. 4. A separating Glas for proving Gold, placed on a lit-  
 XX. tle foot.  
 5. He that ~~washeth~~<sup>wrigh</sup> the Goldish Silver in water.  
 6. The Block, Hammer and stool.

## CHAP. XX.

How to separate Gold and Silver, and how to burn  
 or distil Aqua fort. and prepare Instruments and  
 Clay for the Work.

Section.  
 1.



The Clay.

OW, in respect that to the Burning of *Aqua fort.* there belong many Preparations, it is necessary that of such I write somewhat, and signify the same: Wherefore, I will first speak of the *Clay* where with they use to *Lute* the *Helms* and *Receivers*, and to coat the *Separating* *Glass* which ought to be prepared thus; Take good found and substantial *Clay*, wash it in water that the stones and the coarse sand may come off, make it into Balls, and dry it well in the Sun; Of such wash'd *Clay* take ten parts, and two parts of wash'd *Ashes*, three parts of clean *Stone-Horse-dung*, one part of the *scales* of *Iron*, and two parts of *Cow-hair* beaten well, and mingle all these together, and moisten it with warm *Oxen* or *sheeps-blood*, and whilst it is warm, work it with an *iron Instrument*: one might also take, among this *Clay*, *Venetian Glass* beaten small, but not too much: and with this *Clay* one may lute-over the separating *Glasses* and the great *Glasses*, in which the *Aqua fort.* is to be distilled, such as will hold in the fire: it may also serve to joyn together the *Ovens* which are called *Athanos*,  
 be-

because it holdeth fast, and doth neither break nor crack.

But the *Clay* and thin mixture with which one useth to lute over the *Joynts* of the *Helmets* and *Receivers*, is to be made thus, Take the white of *Eggs*, as many as you think fit, beat them well, in a *Peuter dish*, and take a clean *sponge*, and press the clear of the *Eggs* into it, by squeeing it out of the *sponge* into the *dish*, and do this until it becometh clear like *Well-water*, then take *Mill-dust*, 4 *Loths*, *Bole Armoniak*, one *Loth*, *white dried Cheese without Crust or rind*, two *Loths*, and of *Sanguis Draconis*, one *Loth*; Grind all these very small, and sift them through a hair *Seeve*, mingle these with the whites of the *Eggs*, and with it, *Lute* over the *Joynts*, which you must understand thus, That such *Joynings* be first with the above-mentioned *Clay* luted over and dried well again, then this thin mixture is to be put upon a little cloth and laid over it, and let it dry of it self, but this ought to be done before you bring it into the warmth, or makest a fire to it, then such mixture will hold fast, and the spirits will not go through, but if the *Joynings* should afterwards let the *spirits* go out, then do it over in the heat with *Tallow*, vwhereby the *Clay* will become *hard* and fast.

Here followeth another *Clay* wherewith to lute or glaze-over the *Culbs* or *bottles*, which will endure the fire, Take a good wash'd dry *Clay*, a little *Dragons blood* and *Bole Armoniak*, and add to it a third part of *Potters clay*, & a third part of a half part of *Calx vive*, make each apart into *Pouder*, and moisten it with the white of *Eggs*, as is taught above, or with warm *Ox* or *Sheeps*-blood, add to it so much *flox* of woollen *Cloth* or wooll shav'd or shorn, as of the *Bolus*, mingle all well together with a stick or wand, and with it lute over the *Glasses*, but not thick, also lute over the *joynts* with it, and this vwill hold

CHAP.

XX.

Section.

2.  
To lute the  
joynings.3.  
Another  
Clay to  
bodies.

CHAP. hold fast in the fire. Likewise other *Clays* are to be  
 XX. used to lute-over, which do also hold well: But because  
 these now mentioned do suffice, I have omitted for bre-  
 vity sake to set down others: therefore every one may  
 try which are the most serviceable unto him.

Section.  
 4.  
 Venetian  
 Glass.

The *Glasses* or *Bottles* in which one useth to separate,  
 and in which they put *Aqua fort.* are to be made of  
 good *Venetian Glass*, of an equal thickness in the midst,  
 for if they be made too strong or thick of *Glass*, they  
 will not hold well, but they which have a right equal  
 thickness, and are not strong will endure the fire the bet-  
 ter, but if the *Glasses* be made of other *Glass*, then the  
*Aqua fort.* will work on them; and they are subject to  
 break the sooner, by which there cometh *dammage*, and  
 they will be also dark and pale.

5.  
 To prepare  
 Jugs and  
 Retorts  
 with saw-  
 dust.



One may also cause *Juggs* of *Potters-work* to be  
 made for *Distilling Aqua fort.* or mixing *Clay* with  
*Bran* or clean fine *Sawdust*, this therefore is done, That  
 when the *Juggs* are made and burnt raw, that the *Bran*  
 or *Saw-dust* may burn out, and then to glaze such over  
 with *Venetian glass* within and without, that the *Glass*  
 flow into the *holes*, out of which the *Bran* and *Sawdust*  
 is burnt away, whereby they will prove very firm and  
 hold very well in the fire, of such stuff very good *Re-*  
*torts* are made, which will not break in the fire, but are  
 much better to use than the over-luted *Glass bottles*,  
 therefore such stuff is very convenient to use for *Retorts*:  
 But how great the *Juggs, Glasses* or *Bottles* must be, I  
 conceive, that every ones *Work* will teach what he may  
 make according to it, for if one hath much *Aqua fort.*  
 to burn at once, then it will require a great *Jug* or *Re-*  
*tort* for it, in which the *stuff* is to be put, and also the  
*Recipient* must be the bigger.

6  
 Iron jugs.

Also 'tis in use to burn *Aqua fort.* in *Iron Jugs* which  
 are of two pieces, and can be done asunder, whose form  
 you

you will see in the next *Sculpture*. In such a *Jug* one may set in more at one time than in a *glass-bottle*; also they need not fear the breaking of such *Jugs*, or that the stuff will be spoil'd in it; and the *Gold* hath been of a better colour by such *Aqua fort.* made in *Iron*.

For this and other Reasons, I judge it to be better alwayes to burn *Aqua fort.* in such *Iron Jugs*, than in glaz'd *Bottles*, which can but once be used, the bigness of which must be as one may put in near 20 pounds of stuff at once, but if one would burn less, the Opportunity will shew it self, how to proportion it, but for strength it must be the thickness of a finger, so it will endure the longer.

If now one will burn *Aqua fort.* in such *Jugs* then must the joynings be well luted over, that no spirits may go out, lute over also the Jug without, with thin *Clay*, that the fire may the less hurt it, and lay before it a *Recipient* of *Glass*, but of such a bigness that the mentioned spirits may have room enough in it, and that such may not break out of necessity or force, by which there will be dammage.

After the vvork is finished then must the *Jug* be suffered to cool, and put water in it, then will it mollify the *Caput Mort.* put it out gently with an *Iron*, and so the *Jug* will become clean again.

The form and likeness of such separating *Glasses* and earthen *Jugs* you may see in the following *Sculpture*, thus

Deciphered.

1. A luted glass-bottle covered with an Helm.
2. A luted glass-bottle without an Helm.
3. Another sort of Glass-bottle.
4. The Form of an Helm.
5. An half Glass, or half\* Pipkin with one Ear, and a\* Mouth.

S s

6. A

CHAP.  
XX.

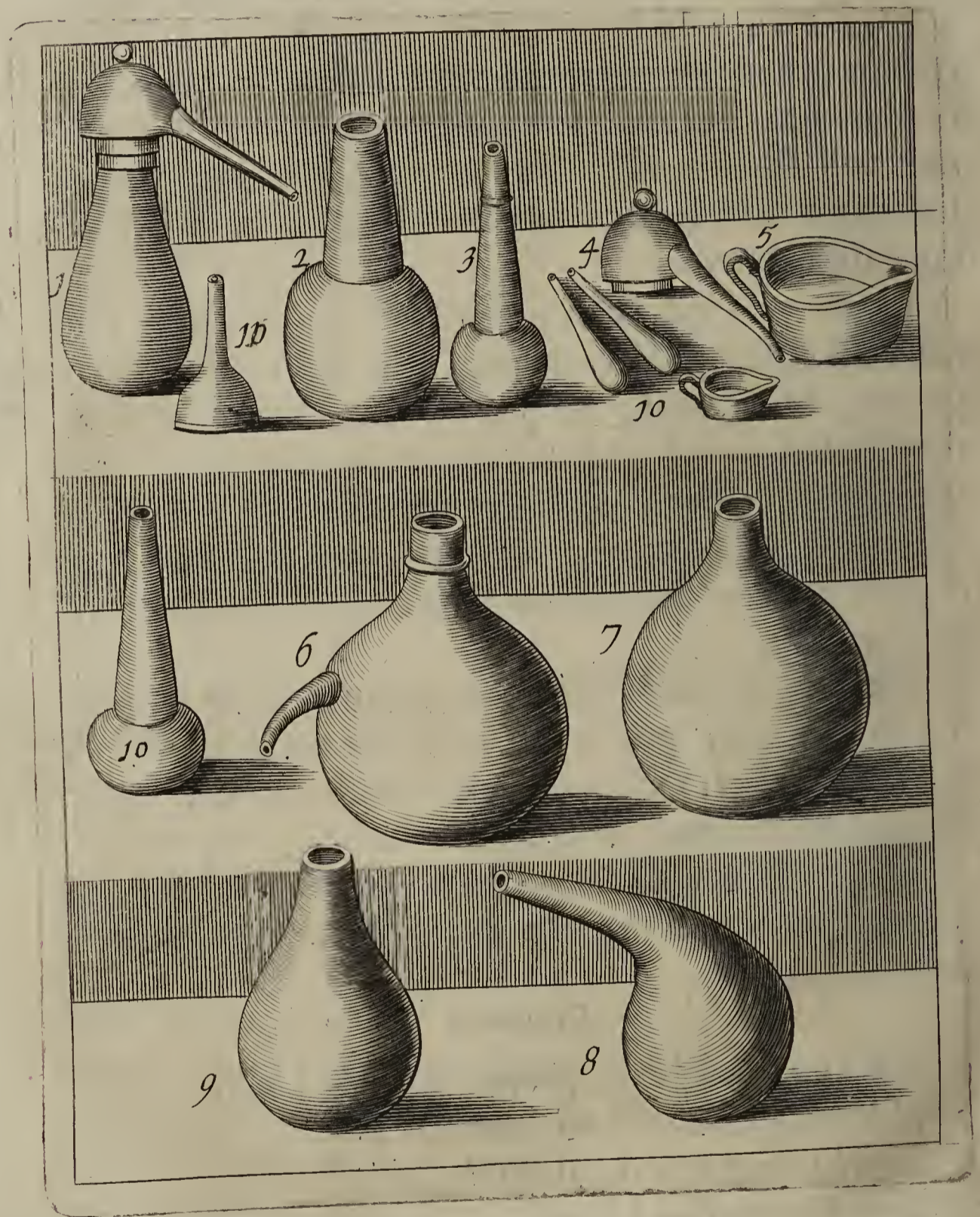
Section.  
7.  
Luting the  
Jug.

8.  
To gain the  
Caput mort  
out of the  
Jug.

\* Abfuzchal

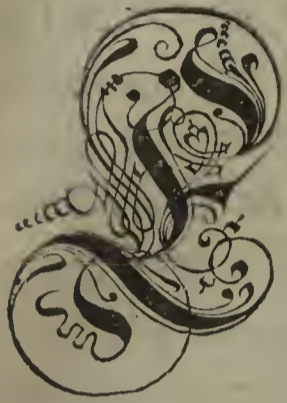
- CHAP. 6. *A Receiver with a Pipe.*  
 XX. 7. *A Receiver without a Pipe.*  
 8. *An earthen Retort.*  
 9. *An earthen Jug or Culb to burn Aqua fort.*  
 10. *Other kind of Bottles, Glasses, half-Glasses, Tunnels.*

Sculpture XX.



## CHAP. XXI.

How to make Ovens to Distill Aqua Fort.



VERY one useth to prepare the *Ovens* to the distilling of *Aqua Fort.* according to his pleasure: But there is one Form much better, and more profitable than the other (as I have seen and used many my self) for I finde, That the *Ovens* called *Athanos*, which, as in the following *Sculpture* is properly delineated, are the best to be used to distil *Aqua fort.* and they are to be formed thus, Make a *Steeple* in *square* or *round* four *Ells* high, and below in it lay an *Iron Grate*, under vvhich must be a *Wind-hole*, according to the demonstration in the next *Sculpture*: and then make again on both sides of the *steeple*, in the same wideness, according to the height of the *Juggs* or *Glass-bottles* round or square *Ovens*, in which the *Glasses* or *Juggs* may stand: Put also below in the *steeple* or *tower*, *Iron-Grates*, so that it may have *wind-boles* below: in such *By-Ovens* must be left *holes* from the *Tower*, that the heat ( as you shall hear ) may come out of it, and if they are about a large span wide, and four fingers and a span high, then are they wide and high enough: only observe, That when you do set up the high *Tower*, you do not make it too thick near to the *holes*, but rather narrower, that the fire or heat may go the better into the *By-Ovens*, then cause to such holes, through which the heat doth pass, fit Instruments of *Potters-work*, with which you may govern the fire as you please.

Section  
1.2.  
*Athanos*

Some

CHAP. XXI. Some cause such Instruments or *Registers* to be made of strong *Iron*, but they are not so good as the earthen, for, if the *Iron* one become hot and glowing, then they give likewise great heat, and if they are drawn before the fire, then they cannot well be managed or govern'd by it, and there is also danger therein.

Further, you must also have to every *By-Oven* (in which you set the *Jugs* or *Glass-Bottles*) covers made of Earth or *Potters-clay*, which must be cut out also, that they close just on the neck of the *Jug* or *Glass-Bottle*, and that the *Ovens* may be shut very close, and leave *Air-holes* through it (being called *Registers*) and have *Pins* of *Wood* which go in very close to govern the *Fire* by it, as you may see in the eighth figure of the next *Sculpture*. Likewise upon the *Tower* a cover is to be set, which must be so large that it may cover all the upper *holes* of the *Tower*; and so is the *Oven* or *Athapor* prepared to distil the *Aqua fort.* But how it should be governed with the *Wind-holes* followeth hereafter in the next *Sculpture*

Deciphered.

1. *The Athapor.*
2. *The Mouth-hole over the Grate.*
3. *The Mouth-hole under the Grate.*
4. *The Grates in the By-Ovens.*
5. *The By-Ovens.*
6. *Instruments to open or shut the By-Ovens Mouth.*
7. *A Cover for the By-Oven.*
8. *The Pins for the Registers or Wind-holes.*
9. *A Semicircle piece of Wood by which the Athapor is to be made round.*
10. *The Cover for the Athapor.*
11. *The person that tends them.*
12. *A dish of Metals to be used.*

Sculpture.





CHAP. XXII.

How the Ingredients are to be prepared for distilling of the Aqua fort.



OR distilling of the common *Aqua fort.* there are used only two *Ingrédients*, *Nitre* and *Vitriol*, which must be prepared before they are put in: first, the *Vitriol* must be *calcined* which is to be done thus, Take at once four pound of those *Ingrédients*

Section.  
1.

Calcining of  
*Vitriol.*

T t

dients

CHAP. XXIII. Section. I. Calcining of Vitriol. dients, and put them in an earthen glazed *Crucible*, set it over the fire, that the *Vitriol* may melt to a water, let it boil gently, and stir it about continually with a wooden *spatula*, until the wateriness be evaporated away, and the *Vitriol* begins to be thick, then take with the wooden *spatula*, some part out of the *Crucible* while it is warm, and grind it upon a *Grinding-stone* before it be cold, then take more out of the *Crucible*, upon the *Grindingstone* until all the *Vitriol* is out of the *Crucible* and ground small, for if you do not take the *Vitriol* warm out of the *Crucible*, but lettest it be cold in it, then it will become as hard as a stone, and so 'tis difficult to be brought out, neither is it easy to grind: Thus the *Vitriol* is to be prepared for the distilling of the *Aqua fort*.

2. Salt-Petre. Concerning the *Nitre*, it needs not be *calcin'd*, yet one may set it upon a *Oven* that it may be dry, and then beat and grind it fine and small, then is it also prepared: But because it is not all pure, but some part of it is very *Salt*, therefore it is first to be *clarified* and purified from its *Salt* (which every one who converseth with *Distillation of Aqua fort*. certainly should know) and that with the hand: But how the clearing should be done, see full *Instruction* in the first *Book*.

## CHAP. XXIII.

How *Aqua fortis* is to be distilled.

1. In a Glass Body.



MAKE four pound of clean *Nitre*, and three pound and a half of *calcin'd Vitriol* (as is mentioned) grind them very small, and put them in an *over-luted Glass-body* (brush'd with an *Hares-foot* bound to a little stick) the neck of the Bottles

Bottles being taken off, that the water may go clean CHAP. XXIII.  
 over, and not have cause to ascend, when then the *stuff*  
 is put into the *Bottle* or *Jugg*, then put it in one of the  
*By-Ovens*, on the *Grate* (with a *Copel* made for it on  
 purpose) and lay upon the *By-Oven* a *Cake* made of  
*Earth* or *Clay*, and daub it close about the neck of the  
*Jug*, and over-lute the joynings every where with the  
*Clay* very well, that no heat or vapours may go out of  
 it, and let the *Air-holes* on the side be open (as you see in  
 the former *Sculpture*) yet not too wide (for if they are  
 open near three fingers wide, then 'tis wide enough:)  
 But you must not put the *Bottle* (as now 'tis mention-  
 ed) naked into the *Oven* upon the *Iron-grate*, as you  
 do with the *Iron Jug*, but in a small earthen *Test* (made  
 on purpose) which hath below a little *Foot* which is  
 called a *Coppel*: and in this put ashes or clean *Sand*,  
 that the *Glass Bottle* may come to stand a good square  
 hand above the *Grate*: when you have put in the *Stuff*  
 set an *Helm* upon it, and dawb the Joynings very well  
 over with the *Clay*, which you have prepared.

But some have another way, *viz.* When the *Bottle*  
 is put in, then they lay round about the *Neck* good pre-  
 pared *Clay*, and over the *Clay* they lay *Paper*, so that the  
*Helm* may not quite stand on the *Clay*, and this is done  
 for this Reason, that the *Helm*, (after the distilling) may  
 loosen it self clean; and then they do set upon it the  
*Helm*, and lute it over with good *Clay*; and lastly, ap-  
 ply the thin stuff upon a little *Cloth*, that no spirits at all  
 may go out.

You ought also to prepare the *By-Oven*, and likewise  
 the *Jug* or *Bottle* with the *Helm* set in Order, that the  
 mouth of the *Helmet* may go out a pretty distance over  
 the *Oven*, then lay before it the *Receiver*, that the mouth  
 of the *Helm* may well reach into it, that you may see  
 how the water doth go, and the drops fall.

And

Section.

2.  
 Copels to  
 burn Aqua  
 Fort.

3.  
 Another  
 way.

4.  
 Water in  
 the Recci-  
 ver.

CHAP.  
XXIV.  
Section.  
5.

And that you may also know how much the *Vitriol* hath lost of its weight; first, in the *Calcining*, you must put sweet or flowing *Water* in the *Receiver*, else the *Water* will be too strong, and very little water will remain, also lute all very well over the *Joynings* on the *Receiver* and *Helm*, thus, Take some of the prepar'd *Clay*, and lay it about the *Joynings*, then put in the *Clay* (through the *joynings*, in the *Receiver*) with a little smooth sprig of a *Broom*) which will do this Service, that the first and gross spirits (as you shall hear hereafter) may come through it; then upon the *Clay* lay a little *Cloth*, as abovesaid, that the *Joynings* may every where be luted-over, and let it be dry: Thus also you may set into the *Oven*, the *Jugs* with the *stuff* on both sides the *Athamor*, and with one fire burn and make perfect two or three works, and mannage every one according to its necessity without hindrance to the other, of giving or taking heat, as hereafter somewhat more may follow.

## CHAP. XXIV.

How *Aqua fortis* is to be distilled in an *Iron Jug* or *Pot*.

i.  
Of *Jugs* cast  
or hammer-  
ed.



UT if you will put the *stuff* in an *Iron Jug*, which is cast or hammered, and distill *Aqua fort.* in it, then put the *Jug* with its short feet, upon an *Iron Grate* or *Roaster*, that it may stand firm and fast, but if the *Jug* hath no legs, then it must stand upon a three-legg'd *Iron*, proportioned to the *Jug*, and before you do put the *Helm* on it, first place upon the *Jugs* neck an old broken neck of a glass *Bottle*, and then

then put the *Helm* upon it, so the *Helm* will remain whole in taking off: But if you have not a *glazed Neck* (as is said) then lute the *Jug's neck* round about with the prepared *Clay*, and lay over the *Clay* a *Paper* (as abovesaid) upon the *Helm*, and over lute it the best you can, then the *Helm* will go from it the better.

When you have set into the *Athamor* the stuff with the *Jug*, and all the over-luting is well dried, then put into the *Tower* of the *Athamor*, live *Coals* upon the same, with other *dead Coals*; so that the *Tower* may be full to the top; then cover the *Tower* with a thick *Cover* made of *Potters-Earth*, but you must lay *Ashes* upon the *Tower* half an hand thick, and so fit the *Cover*, that no *vapor* at all may goe out, and let the *wind-hole* below, on the *Athamor*, be open which is mark'd in the before said *Sculpture*, with *Figure 3*: and shut the *wind-holes* of the *By-ovens*, and the *Mouth-hole* of the *Athamor* very close, mark'd with the *figure 2*. and draw it not open too soon with the *Instruments* noted at *Figure 6*.

But, when the *Aqua fort.* doth begin to go, then open but one *wind-hole*, and, if it will not go well, then draw the *Instruments* a little nearer to the *Tower*, so the heat will go through the same space, under the *Jug* or *Bottle* which is set in, and in which the *Ingredients* are, and presently, the water will begin to run better.

Now, if it thus proceeds, then a *Vapour* will come into the *Receiver* (these are the *gross spirits*) then let them go out through the little *Pin* of *Wood* near the *Lymbek* of the *Helm*, then stick it in again, and lute it over the best way you can, that no more *spirits* may go out, and when the drops fall into the *Receiver* to five or six, so the water will go in the beginning from the *calcination stuff*, with which governing, shutting and opening of the *Instruments*, you may alwayes keep the *Oven* in order that the water may go well. But when you put the *stuff*

CHAP.  
XXIV.

Section:  
2.  
To place the  
same,

3.  
Of governing  
ing the *A-*  
*thamor*.

4.  
Of disposing  
the *gross spi-*  
*rits*.

CHAP. *raw*, uncalcined in ; then you must do it very gently in  
 XXIV. the beginning, that the *drops* may fall in , to .15 and  
 16, &c. But 'tis a tedious and long while in distilling ,  
 and there can no more water be had than of the *calcined*  
*stuff* , therefore it is always first to be *calcined* , and when  
 from the *calcined stuff* , the *drops* are fallen one or two  
 hours to 5, 6 and 7 *drops* , then you may draw a little  
 more with the *Instruments* which are between the *Atha-*  
*nor* and *By-Ovens* , and then the heat will be stronger , and  
 the *Drops* will fall faster.

Section.  
 5.  
 When it doth  
 go too hot.  
 Now, when the *Drops* come but to two and three,  
 it goeth too hot : then with the mentioned *Instrument*  
 shut the under *wind-hole* again, very close: whereby they  
 will go slower again, for in too hot going there is danger,  
 that the *stuff* should ascend, and dash all in pieces (where-  
 by cometh Dammage) and although the *calcined stuff*  
 doth not easily ascend, yet it may so happen in going  
 on (especially if the *Jugg* be filled too much with the  
*stuff*.)

6.  
 How the  
 drops must  
 be counted.  
 And know that You must number the drops accord-  
 ing as one beateth with a hammer or fist , or keepeth a  
*tact* or time as in Musick : viz. as many common *stroaks*  
 as can be done betwxt the drops, may be 4, or 5, or  
 more, they are to be called *stroaks* , therefore govern  
 the fire also in an equal heat, untill the water come al-  
 most over, and the *Helm* and *Receiver* become *Cherry-*  
*brown*.

7.  
 To force the  
 spirits.  
 Then you must strengthen the fire with opening of the  
*Instruments* while the *Spirits* go through the *Limbeck*  
 or *Nosel* of the *Helm* and *Receiver* of the water ,  
 by which the *Helm* and *Receiver* (as is said) becomes  
 brown. Then hasten not with the forcing of the fire, till at  
 last, when the *spirit* is gone an hour to six or more, accord-  
 ing to the quantity of the *stuff* , and the *Receiver* be no  
 more so brown, then open the *Wind-holes* markd with  
 the

the figure 8. and lay in the same holes under the Jug or Bottle) small split Wood, and force it with the fierceness of the flame, that the rest of the spirits may come over, and that all strength may come into the water, so as the Helm and Receiver become white again, and that also the Jug or Bottle which is put in, may glow near an hour well with the Caput mort. so that which remaineth behind in the Jug or glass, may have no more sharpness in it but become dry and of a reddish Brown.

When the Aqua fort. is thus distilled, then let the Athanor be opened and cool well, and lay over (above the neck of the Helmet, where it is luted) a wet cloth, also near the Limbeck of the Helm over the Receiver, mollifying the overluted hard Clay well, that it may go off, that you may not break the Limbeck of the Helm, which you may use afterwards (the Receiver being first to be taken away) then put the made Aqua fort. into a Glass, and stopt it with wax: thus you have good Aqua fort.

Section.  
8.  
The Glass  
Limbeck  
and Receiver  
to be  
taken off.

You may also be instructed, That when you are distilling of Aqua fort. and that the Coals in the Athanor are almost gone out (which happens hardly in 10 or 11 hours) then lift up the Cover from the Athanor, make it full again with Coals and cover it, else the Fire will go out, and all will be cold, as Opportunity it self will teach thee and make thee to remember.

## CHAP. XXV.

How to distil Aqua fort. in 4, or 5 Hours.



F one in haste would distil Aqua fort. and cannot have such an Athanor, then must be made a little Oven on a wall three quarters of an Ell square, and two Ells high, and put in it an Iron-Grate, so that below there may remain a Wind-hole,

i:

CHAP. *hole*, and on this little *Oven* make another little *Oven*, in  
 XXV. which may be put the *Jug* with the *stuff*, cause an *Hole* to  
 go out of the *Oven*, which is set first into the *By-Oven*,  
 lay also a *Grate* in it, as you have done in the *Atba-*  
*nor*, and you may in stead of the earthen Instrument  
 before noted with *Figure 1.* use a smooth *Pan-tile*, and  
 it will do the same thing: or, if you will not spend so  
 much time about an *Oven*, then make but one square  
*Oven*, which hath a *grate* below, and under it a *winde-*  
*hole*, in which you may set the *Jug* or *Bottle* with the  
*stuff*, take then of the above-mentioned *stuff* four pound  
 of *Nitre*, and three pound and an half of *calcined Vi-*  
*triol*; Grind both very small, and among it put six  
 pound of *Calx viva*, and let all be well mingled toge-  
 ther (but put not so much water in the *Receiver*, as  
 above is taught.)

Section.  
2.

Now therefore, when all things are well *luted*  
 over, and become dry, then make a fire under it, and  
 let the water go strong over it, so that at all times the  
 water and spirit may come over together, and because  
 the *stuff* is mingled with *Calx viva*, therefore you need  
 not take care for running over, then strengthen the  
 fire immediately untill the water and spirits are come  
 over.

3.  
 And lastly, the *stuff* in the *Jug* will glow so well  
 through this Labour, that you may distil in 5 or 6 hours  
 an *Aqua fort.* to which else you must have 24 hours,  
 but you will have but little water, yet 'twill be very  
 good to use for *Separation*.

CHAP.



## CHAP. XXVI.

*Another good way to distil Aqua fort.*



**S**o use uncalcin'd *Vitriol* for *Aqua fort.* it must be dryed in the *Sun* till it be *white*, then take thereof four pound, and two pound of *Salt-Petre*, beat it small; mingle it together, and set it in the *Oven* (as is done with the first *stuff*) put no sweet or clear water into the *Receiver*: this also yields good *Aqua fort.* only you must (as above said) do very gently in going on, that the *stuff* may not run over:

Take to such *Aqua fort.* good *Hungarian* or *Goslarish Vitriol*, or which is boyled out of a flint, and of a fine and high colour, and not of such *Vitriol* of which *Alum* is made, for the pale *Alumish Vitriols* do not yield good strong *Aqua fort.* Some take also one part of *Copper* water, and burn *Alum* among their *Additions*, which is left to every ones freedom. This only is needful to be mentioned, That if one take much *Vitriol* among the *stuff*, such *Aqua fort.* which cometh out of it, doth very well work in separating, and gives much brown spirit, nor do they improve in the separation, as other *Aqua fort.* for they hold not fast on in separation.

Likewise some take to their *Aqua fort.* four pound of *Nitre* and as much *Vitriol*, which of the two is the best, you may (like my self and others) learn by Experience.

Section.

1.  
To use uncalcin'd *Vitriol.*2.  
*Hungarian, Goslarish Vitriol, or such as is boyled out of flints.*3.  
*Another way.*

CHAP.  
XXVII.

## CHAP. XXVII.

*How to make an Excellent strong Aqua fort.*

Section.  
I.  
The Ingre-  
dients.



YOU must, for the making of strong *Aqua fort.* Take three pound of *calcined Vitriol*, 3 pound of *Nitre*, one pound of burnt *Bruxish Alum*, out of *Belgia*, and two pound of burnt flints; burn these to a *water*, the first *water* let go, untill the *Helm* begins to be colored, cast it away, lay the *Recipient* again before it, and lute it all over vvell again, and let the other vvaters go over (as I have taught above) at last, force all the spirits over vvith a strong fire: this *water* keep in a good *Vessel*, and put to it, in an overluted *glass Bottle*, 6 *Loths* of *Nitre*, 4 *Loths* of *Vitriol*, and two *Loths* of burnt flints, and one *Loth* of *Verdigrease*, and one *Loth* of roasted *Antimony*, and one *Loth* of filed *Iron*, and half a pound of *white Lead*, and let all these be beaten to small powder, and put upon it, of the *Water* now distill'd, a little and a little at a time (for it useth to make a *Noise* until 'tis all put in) then cover it very vvell, let it stand some dayes in a *Celler*, and stir it every day twice, then set it in and distill it as an *Aqua fort.* only that the *Helm* may soon come upon it, and let it go as long as 'tvill go, for it vvill begin of its ovvn accord to go; then give it very gentle fire, and dravv it most gently over so long till all the water is brought over; then augment the fire, the fiercer the better, until the spirits vvith great heat are all come over, (which hardly is done in two dayes and two nights) like as you have done before with the *Aqua fort.* then let the *Oven* be cool, and take of the *Aqua fort.* and cleanse

it

it from the *feces*, and preserve it in a sound Vessel which holdeth well, for 'tis an exceeding strong water, and use it. CHAP.  
XXVIII.

Some will say of this Water, That by it somewhat more of *Gold*, in the Separation, is to be obtain'd, than by common *Aqua fort.* Experience will manifest it; for my part, I believe it not: and for such Hopes without ground, I was neither willing to expect, nor to try in distilling.

Section.  
2.  
More Gold  
by this way.

You may also be instructed, That to this Water you had need of a *great Recipient*, wherein the spirits may have room; and, if you will take off the *Recipient*, and lay it before again, then you may lute over the *Joy-nings* with *lute* made of two parts *Clay*, and one part of *Quick lime*, and moistned with ~~Rose~~ *Oyl*, and lute it: such a *Clay* the spirits do not touch, but the other which is used, by some, to lute with, they touch, and thereby are made alwayes leaky, and never holds well.

3.  
A Lute up.  
on which the  
spirits do not  
work.

Insisted

## CHAP. XXVIII.

*How to distil an Aqua fortis, called Aqua Regis, which dissolveth Gold, Copper, Iron, Lead and Tin; also Mercury sublimate and Arsnick.*



**P**ROVIDE good *Aqua fort.* which is distilled only from *Salt-Petre* and *Vitriol*, and purified with *Silver* from its *dregs* and *feces*, and in which one may dissolve *Silver* as necessity requires, put it into a sound well luted *glass Bottle* or *Culb*, and add 8 *Loths* of *melted Salt*, which *Salt* in flowing must not run over, but as soon as it floweth must be put out, that it may remain in its strength and virtue,

1.  
Ingredients.

CHAP. XXVIII. virtue, and only come off from the flegm or superfluous moisture; now, as soon as the Salt comes in it, then lay the luted glass Bottle with the *Aqua fort.* and Salt side-ways in the *Oven* in which one useth to distil *Aqua fort.* but thus, That you may lay to the *Bottle* the *Recipient* also, and lute it well, then it will soon begin to go off, by its own *Virtue*; then draw the *flegm* over with a small fire, and strengthening the fire more and more, at last force the spirits to come over, as is usual in distilling the *Aqua fort.* and you must drive the spirits much longer because of the *Salt*.

Section.

<sup>2.</sup>  
To draw over by degrees.

Then you may finde that by this way of distilling by degrees, there will be a fine *yellow* and stronger *water*, because the spirits will not ascend too high, (as over the *Alembeck*;) But it requires good diligence and observation to prevent the water from running over: This *Aqua Regis* when 'tis thus burnt, may presently be used, and hath no need to be purified from its *feces*.

But how to *distil* it by degrees you may see in the following *Sculpture*, thus

Deciphered,

1. *The Tower of the Athanor, in which the Coals are to be put.*
2. *The Oven in which the Bottle is to be plac'd.*
3. *How the Bottle is to ly in the Oven.*
4. *The Glassy Helmet, made for it.*
5. *The Recipient or Receiver.*
6. *The Pot full of Materials prepared.*
7. *The empty Pot.*
8. *The Person that tends the Athanor and By-Ovens.*

Sculpture



CHAP. XXIX.

To distil Aqua fort. in Retorts with other Advantages.



**D**ISTILLING *Aqua fort.* in Retorts is no old *Invention*, and no long Labour, but a short way; if Retorts may be had which are made of one piece, and will hold *Aqua fort.* and *Oyl*; then lute such over with good and sound *Clay*, let it be well dry, put in it the *Ingredients* or *stuff*, which shall be *calcin'd* and mingled with *Calx viva*, and lay the *Retort* in an *Oven* made on purpose (whose Description shall follow hereafter) and fill a *Receiver* with water before it, then make a fire in the *Oven* (and speedily

Section  
I.

Y y

ly

CHAP.  
XXIX.  
Section.

2.  
Calx viva  
hinders the  
running over

3.  
For want of  
a Receiver.

4.  
Earthen Re-  
ceivers with  
Glasses.

5.  
To fit the  
glass spouts  
to the Helm.

ly increase it) then the *stuff*, because it is mingled with *Calx viva*, will not run so soon over, because the *spirits* and water are to go over together, at last force the *spirits* with *Fire*, so that the *Retort* may glow bright, near two hours, at least: In such a *Retort* you may distill the *Aqua fort.* in 5 or 6 hours, but it will not yield so much water as through the *Alimbeck*, but it will be strong and good for use.

If you cannot have a great *Receiver* (as it often happens) to the distilling of the *Aqua fort.* then take a great *Waldenburgish Fug*, or one made of the like *Clay*, (that it may hold *Aqua fort.* lay that before as a *Receiver*, and make the *Process*, as now is signified, such an one I esteem better to the distilling of *Aqua fort.* in *Retorts*, than in a *glazed Receiver*.

But when you will use it (in stead of the *glazed Receivers* to lay before the *Fug* and *Helm*) then you must have a neck of a *glass Bottle*: Lute it well over in the *Fug*, so that the *Neck* may reach out of the *Fug* near a *Span*, in the same *Neck* lay the *nossel* of the *Helm*, and lute it also well over, so you may see in the neck of the *glass Bottle*, how the drops do fall, and govern the fire accordingly.

Some who distil *Aqua fort.* do make (on purpose for the *Receiver*) great *Fugs* with great *Bellies*, of good and solid *Clay*, so that near the *Fug's* neck, are to be cut in it square holes, then they fit to it square *Glasses* of good *Venetian Glass*, and then they lute over the *Fugg* with a thin *Clay* made of *Varnish* and *Bole Armoniack*, and cause it to be dryed well, and when they will lay the *Fug* before, then they place the *Glasses* to the *Fug* and *Nossel* of the *Helm*, so that they may see the drops fall well, and that they may govern the *fire* as it should be.

Also it often comes to pass, that the *Helms* have not  
alwayes

always right *spouts*, they are either too high or too low: CHAP.  
XXIX.  
Now, these you may make your self, as followeth, *viz.* flake a Coal-fire upon a *Test*, hold the *spout* so as that it may be only warm, then nearer and nearer; at last, lay it on the glowing Coals, and the *nosel* will glow, then bow it in the fire, as you wouldst have it, but you must not take it so quickly out of the fire again, lest it break in pieces, according to this way others are to be bent and fitted like *Pellicans*.

I have taught before, how the *Ovens* are to be made and prepared in which *Aqua fort.* is to be distilled: if it now should happen, that one would at once resolve to distil more than two at a time: then for such the *Athanasior* must be made somewhat greater and larger than for others, but not much, yet may serve three or four *By-Ovens*, which are to be governed with one fire, only the *Instruments* which in other *Athanasors* are drawn on the sides, in this must be drawn upwards, and hang them on the wall by nails, as the following *Sculpture* doth shew.

Section:  
6  
To set By-  
Ovens to an  
Athanasior.

Besides this, one may make another *Oven* to distill Quantities, in which four or more Jugs may be set in length one after another: so that the *Oven* standeth free, and you may alwayes come to lay one *Receiver* on one side, and also another on the other side; for this Reason, not only that it may not hinder one the other, but also that on the backside under every *Jug* may be laid wood, and that the spirits may be forced strongly.

7.  
Another long  
Oven.

Besides, such an *Oven* must have on the lowest part but one *hole*, in which the fire upon a *grate* is to be stored with wood, and under the *grate* one *wind-hole* more, and the same must not be opened, till the water is almost over, that one may strengthen the heat; likewise on the upper part, as on the head must be placed  
one

CHAP. *wind-hole*, that the fire may have its draught in the  
 XXIX. length.

Section.  
8.

If then you would distill *Aqua fort.* in such an *Oven*, then first *calcine*, and prepare the *stuff* afterwards; put it into the *Jugs*, and the first *Jugg* which stands next the fire mingle with *Calx*, then there will not be so much danger, that the *stuff* will run over: After this, when the water is almost over, then open the *wind-boles*, which are alwaies to be behind by the *Jugs*, and force the *spirits* over, according to every *stuff's* necessity, by this you will have also good *Aqua fort.* and maist distil much of it at once, but how the *Oven* is to be formed you may see at the *figure 7.* in the next *Sculpture.*

9.  
Strong and  
weak Aqua  
fort.

But to return to the *Aqua fort.* I find it necessary to mention, That some conceive, if they have too strong *Aqua fort.* they will go as far in separating one *Mark*, as of two *Marks* with weak *Aqua fort.* which cannot be: the Reason is, that though the strong *Aqua fortis* do touch strongly, yet it cannot take more *Silver* to it self, than the *Aqua fort.* hath wetness: I say then, That an *Aqua fort.* which is of a middle strength, and made of good *stuff* doth more in separating according to its worth, than a very strong water, for the weak water endures longer in the operation, on the contrary the very strong water consumeth away suddenly, and leaveth off the sooner. The following *Sculpture*

Deciphered.

1. *The Tower of the Athanor.*
2. *The two sides or By-ovens in which the Jugs are to be set, with the Stuff. 2. 2.*
3. *The Glass Receivers. 3. 3.*
4. *The earthen Jug or Receiver.*
5. *The Oven for the Retorts.*
6. *The little Receivers to be added to the great Receiver,*



ver, that there may be room for drawing the Spirits.

7. The Long Oven.

8. The By-Ovens, by which the spirits are to be forc'd into the Aqua fort.

Sculpture XXIII.



CHAP.  
XXX.

## CHAP. XXX.

*How Aqua fort. is to be separated and cleansed from its Feces.*

Section.  
1.  
The way.



WHEN the *Aqua fort.* is distilled, (according to the *Instruction* given) then it is not to be used *raw*, as it comes from distilling, but it must be first cleansed and precipitated from its *feces*; that it may be pure and clear; and this is done thus; If the distilled *Aqua fort.* be two pounds, then put near 2 *lots* of it into a little glass *Vial*, and dissolve in it half a *dram* of fine *silver*, and while the *Solution* is yet warm, put in, the other new burnt *Aqua fort.* so it will become white and thick as milk, stir it once or twice a day, every day, then let it stand one day, and one night till the *feces* do settle in the bottom like a *Calx*, when it is become wholly clean and clear, then put it off, and you have purified or precipitated the *Aqua fort.* for the separation prepared; only take notice that the *Aqua fort.* distill'd in an *Iron Jug.* doth not give so much *feces*, neither is it so unclean as that which is burnt in a glass *Bottle*, because the *Iron-Jug* is a Metal of it self, upon which the *Aqua fort.* doth partly purify it self, and it likewise gives to the *Gold* a higher and finer colour than the other: Keep the *feces* clean together, pour it off, enter them into the *Lead*, and let it go off upon a *Copel*, so you will find the most part of the *Silver* in it, which you have used to the *precipitation*.

2.  
To bring the  
feces to pro-  
fit.

Some use this Method, *viz.* They do precipitate the new distilled *Aqua fort.* with *Hungarian* or *Bohemish Pence*, or such like Money, which to the separating is all

all one, only the *Aqua fort.* remains not so clear, fine and white, but because there is *Copper* in it, therefore the *Aqua fort.* becomes a little green: for this Reason, this *Aqua fort.* settled with *Coppery Money* cannot be used to the *Gold-Proof*, for the *Copper* which is in the water sticks rather to the *Gold Calx* than to the *Silver*, and then 'tis not easily wash'd off so clean: which is prejudicial to the *Proof*: but, if after the first settling, the *Aqua fort.* be unclean, then you may settle it once more, and then use it to Separate or prove *Gold*, according to your pleasure.

CHAP.  
XXXI.

## CHAP. XXXI.

*How weak Aqua fort is to be made stronger.*



IF it should be neglected in the distilling of the *Aqua fort.* as easily may be done, when the *Joynings* are not well luted over, so that the water will become too weak, and in the separating will not touch the *Silver*: such weak waters may be made stronger by two wayes: *First*, set in again a new *stuff* of *Nitre*, and *calcined Vitriol*, and put the weak *Aqua fort.* in the *Receiver* before it, and distil the *stuff*: after this make the *spirits* to go well over, so the *Aqua fort.* will become stronger, that it may be used well and safely in separations.

The other way is shorter: thus, Set the weak *Aqua fort.* in a glass *Bottle* or *Culb*, which must be luted over upon a *Coal-fire*, heat it till it begin to boil, then the wateriness of it will boil off, which you may often prove while it is boyling, whether the water do become strong enough. Or, set the weak *Aqua fort.* in a *Bottle*, which is luted over

Section  
1.  
To Prepare  
iron.

2.  
Second pro-  
ceeding.

CHAP. XXXII. over in the *Athamor*, or in another *Oven*, (in which one useth to burn *Aqua fort.*) and put an *Helm* upon it, and draw off from it the *Flegm* or superfluous wateriness, until the *Helm* begins to be brown, so the weak *Aqua fort.* will become stronger and is fit for use.

Section.  
3.  
To draw off  
the flegm.

The *Flegm* which is drawn off you may retain, for if you do distil another *Aqua fort.* then you may use it in the *Receiver* again, for this *flegm* is much better than common water.

## CHAP. XXXII.

How Gold and Silver in the *Aqua fort.* is to be separated.

I.  
The Preparation.



SO separate *Gold* from *Goldish Silver* in the *Aqua fort.* Know that the *Silver* must first be burnt clean upon a *Test*, then cast it into an *Ingot*, and beat it thin upon an *Anvil*, and cut it into little *lamins* or thin pieces, bovv them that they become hollov, glovv them in a *Crucible* that the *Aqua fort.* may touch them the better, such glovved *Lamins* vwhen they are cold, put them into a luted neck separating *Glass*, and put not above five or six of those *Mark-Goldish-silver Lamins* in at once; (because of the *Danger* in breaking,) and if you have much *Silver* (for they take much room vwith the *Bottles*) then put upon it so much of the purify'd and settled *Aqua fort.* that it go over the *Silver* a good large *Finger*, and as soon as it begins to vvork of it self, put the separating *Glass* vwith the *Silver* upon a warm *Sand* in a great earthen *Test* of good stuff upon an *Athamor*, that the *Sand*, may alvvays remain hot, and vwhen the first

first *Aqua fort.* hath work enough; that it will touch no more, then put away the *Silvery Water* into another luted *Bottle*, but not too hot, that the *Bottle* may not break, and put upon it other good *Aqua fort.* which hath not been used, set it in warm *Sand*, and let it work the second time, but a little stronger than at first, until it will work no more: Then put it clean off to the *Silvery Aqua fort.* and put upon it the third time *Aqua fort.* and set it upon the *hot Sand*, and let it work strongly, and with great *Bubbles*, until all the *Silver* be dissolved from the *Gold*, which will come out very clean through the three waters now mentioned: But, if one had more to separate, one might use the last water upon other *Silver*, and put it upon it the first time, for it will touch and work so that somewhat of the *Aqua fort.* may be spared.

CHAP.  
XXXII

Know also, that upon one *Mark* of beaten *Silver*, there will remain one *Mark* and a half of good *Aqua fort.* and upon a *Mark* of *thin grained Silver*, (because the *Grains* remain somewhat thicker, and not so light as in beating) two *Marks*; now when the *Aqua fort.* hath separated and attracted all the *Silver* from the *Gold*, then put the *Silvery Aqua fort.* together in a *Bottle*, as above said, and upon the *Gold* or *Gold Calx* (which remains in the *Bottle*) clean, boiling *hot water*, so that it go well over the *Gold*, and put it over again, let it boyl well with the *Gold calx*, then put it off in a particular *Vessel*, clean and pure, that nothing come off from the *Gold*, and put upon it another clean *hot water*, let it boyl with it, do this until the water goes off from the *Gold* very clean and clear, and hath no *sharpness* at all in it, and that it take to it self the remaining *Silver* which the *Aqua fort.* hath left behind with the *Gold* in the moistness, till it cometh clean, this is called *dulcifying*, but that you may be sure, that you have the *Silver* sweetned clean, prove it

Section.  
2.  
The Second  
Proceeding.

3.  
To dulcify  
the Gold  
Calx.

A a a

thus

CHAP. thus, let fall a drop in a *Coppery clean dish*, and if it do  
 XXXII. not stain it, then 'tis *dulcified* clean, such sweet waters  
 are all to be put together, because of the *Silver* in it, and  
 use it for *precipitation*, (of which you shall have an in-  
 struction hereafter) When the *Gold calx* after this man-  
 ner is taken clean off, then hold in your hand the *Bot-  
 tle*, and put the *Gold* or *Gold calx* very gently out into  
 an half *Glass Bottle*, with the last clean water together ;  
 then put it again into the *Bottle* or *Culb*, and hold your  
 hand before it again, and turn the *Culb* so that all the  
 remainder of the *Gold* (together with the water) may  
 flow against the *hand*, then put it finely and gently to  
 the other *Gold* in the *half Bottle*.

Section.

4.  
 To glow out  
 the Gold  
 Calx.

When all the *Gold calx* is settled in the half *Glass  
 Bottle*, then drain the water off cleanly, and put also  
 the *Gold calx* (being moist) into a clean *Crucible*, and  
 set it on the fire, and let the water softly *evaporate*, and  
 boyl in ; then set the *Crucible* warmer, and at the last  
 very hot, that the *Gold calx* may glow clean out, then  
 the *Gold* will receive a fine *colour*, let it be cold, and  
 weigh it, then in the casting all together nothing will go  
 from it.

5.  
 To cast the  
 Gold.

Now if you will cast together the *glowed Gold calx*  
 then mingle it with a little *Borax*, and put it in a new clean  
*Crucible*, (but rub it at first very clean with chalk) and set  
 it in the *Fire*, and when the *Crucible* gloweth, blow to  
 it that the *Gold* may come to flow, of this you may use a  
 little in the *Fluss*, and when you will cast it, then lay  
 a clean little *Paper* upon it, which is *Luted* with *Ve-  
 netian Soap* and *Wax*, and while the *Paper* yet burns  
 upon the *Gold*, cast it out under the *Flames*, so it will  
 receive no *scum*, but will casts it self also clean, but  
 if you will cast an *Ingot*, then make the *Ingot* warm,  
 and *Lute* it with *Wax*, and then quench the cast *Ingot*  
 with *Urine*, and so the *Gold* will become *fine* and  
 dest. But

But if one have much to separate, if it be *Golden grain'd* or *Gilt Silver*, and you would separate it in the water, then it must be first burnt clean upon a *Test*, and the burnt *Silver* must be *Grained*, (for it would be a hindrance to the *Separator*, if all *Silver* should be beaten) especially in a great quantity, yet he who hath time and opportunity, will do better to beat the *Silver*, or cause it to be beaten, whereby the separation will be done sooner and with less *Aqua fort.* (as above is signified) but if you want time and opportunity to beat it, then take the burnt *Goldish Silver*, and set it in a *Crucible* in a *Wind Oven*, and grain it with a split or round stick, or stir the water with a stick fast about in the *Vessel*, to make the *Silver* cast itself into *Bubbles*, whereby it will grain it self thin and hollow, and when 'tis drayn'd, then dry and glow it, and put it in the *separating Glass*, and put *Aqua fort.* upon it, that it may go over it pretty well, and set an *Alimbeck* upon it, that it may begin to move of it self, and, when it ceaseth working, then set the separating *glass* upon the *Copels* in the sand upon the *Athamor*, and let the *Alimbeck* or *Helm* stand continually upon it, and what *Water* goeth off from the *Aqua fort.* keep that same by it self, for 'tis in the distilling of the *Aqua fort.* to be put into the *Receiver*, and is better than common *Aqua fort.* and you must still govern the fire in the *Athamor* by strengthening and weakning it as the work requires: and of this *grain'd Silver*, put 9 or 10 *Mark* of it into a bottle at once, for it will not take so much room as the beaten, yet if there were a quantity to separate of the *Golden silver*, one may prepare more of such *Athamors* than one, that divers of the *Bottles* may be set in at once, but you ought to observe this, that one must put upon the *Grain'd* more than three times fresh *Aqua fort.* for the thick *Grains* sake, that the *Gold* may be pure.

CHAP.  
XXXII.  
Section:  
6.

7.  
To separate  
the Silver  
for granulati-  
ting.

8  
*Aqua fort.*  
for the gra-  
nulated  
*Silver.*

And

CHAP.  
XXXII.  
Section.

9.  
When a glass  
Bottle  
breaks:

And if it happens that a *Glass Bottle* should break, and the *Silvery Aqua fort.* run into the *sand*, 'tis not quite lost, for one may boil most part of the *Silver* out of the *Sand* again with warm *Water*, and that which remains in the *sand* may be mingled with that which is swept off, and passes through the *melt Oven*, and be made to profit, but of such danger there is little Fear upon the *Atbanor*, especially if you have good *separating Glasses*, and also are *careful*.

10.  
To dulcify  
the *Silver*.

When the *Silver* is separated clean from the *Gold* then sweeten the *Gold Calx* well out, *dry, glow* and *cast* it together (as often as hath been mentioned) and know, if you have been diligent in separating and sweetning it the *Gold* which comes out by the separation, will be 23 *Carats* and one *grain*; but commonly it cometh to 23 *Carats* and 7 or 8 *grains*.

11.  
The Content  
of parted  
*Gold*.

Further, I add as a *Caution*, That you must not let the *Aqua fort.* evaporate too dry upon the *Gold* (as many times it happens by *Negligence*) whereby the *Silver* can not set it self on the *Gold Calx* again, which afterwards the other *Aqua fort.* will hardly touch, and therefore so soon as one part of the last *Aqua fort.* be poured from the *Gold*, one should quickly cast upon it hot flowing water before it be cold, that the *Silver* may not settle it self too hard on the *Gold*, and turn to *Cristals*, and though hot boyling water will dissolve those *Cristals*; yet 'tis better, it may not be, but be soon dulcified.

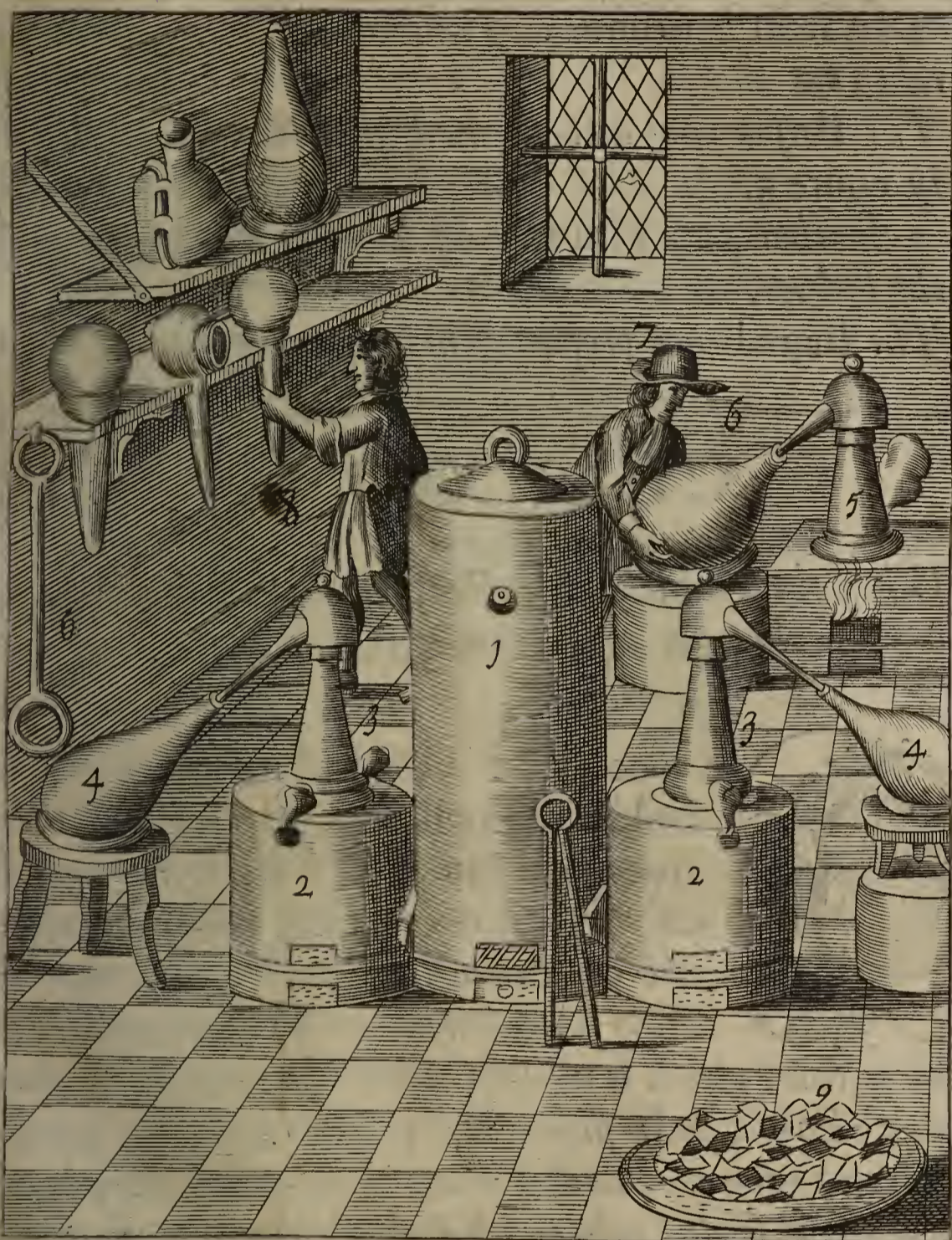
12.  
To shute in-  
to *Cristals*.

13.  
When the  
*Aqua fort.*  
remains  
*Silver*.

Likewise, if it be neglected so that the *Gold* should come too white out of the separation, and were not of a high Content, then it is by the *Cement* (as in next *Sculpture* is signified) to be perfectly cleansed. But that you may understand the Labour of the *Separation*, and how the *Ovens* and *separating Glasses* use to stand, you will also see in the following *Sculpture*.

CHAP.





Deciphered.

1. *The Tower of the Athanor.*
2. *The Side-Ovens upon which the Copels are placed on Sand.*
3. *The Glass Bottle for Separation covered with Hel-  
mets, 3. 3.*

B b b

4. *The*

- CHAP. 4. *The Receivers which are laid to the Helmets.*  
 XXXIII. 5. *How Aqua fortis is by them to be drawn from the Silver.*  
 6. *An Iron Instrument by which the Glasses are to be taken out and in.*  
 7. *The Person that attends the Operation of the Glasses, in figure 5.*  
 8. *Another person to take off and put on Glasses upon the shelves.*  
 9. *The Ingredients prepared, in a dish or pan.*

### CHAP. XXXIII.

*When the Gold is abstracted, how the Silver is to be brought again, out of Aqua fort.*

Section.  
I.



IF one have dissolv'd *silver* from the Gold, through *Aqua fortis*, and the *Aqua fort.* hath suck'd the same into it self, and if one would bring it again out of the *Aqua fortis*; this may be done several wayes. The common Method is this (which is used by most *Goldsmiths*) if they separate but a little *silver*, and require no great pains, then they take the settled water with which they have purified the *Gold* (as is said before) and put it in an half Bottle made of *Copper*, to the *silvery Aqua fortis*: only observe the right measure, for if the settled water be but little, and on the contrary, if the *silvery Aqua fort.* be too much, then it will begin to work too hard in the *Copper Bottle*: to prevent this, put into the *Copper Bottle*, to the settled water, and to the inweighed *Aqua fort.* a little more warm common flowing water, and then it will not so much hurt the *Copper-bottle*; and  
 the

the *Silver* will quickly and apparently fall down in the CHAP.  
*Copper Bottle* : Let it stand a while, then put the *Cop-* XXXIII.  
*Bottle* (together with the water and fallen *Silver*)  
 over the fire, let it boyl a little, then the *Silver* will  
 the better and closer come together.

When this is done, then cause it to settle and pour  
 the clean water off (which will be fair, clear and transpa-  
 rent) put the *silver Calx* into an half-*Glass* bottle, or,  
 if it be much, then into a clean Kettle, and pour clean  
 warm water upon it, two or three times, until the *silver*  
*Calx* be clean and pure, and see that the *silver* alwayes  
 settle well, and preserve it carefully together, that nothing  
 be lost.

The Reason why the *silver Calx* must be dulcified, is  
 Because the sharpness which the *Aqua fort.* hath left in  
 it may come out of it, for the sharpness doth rob some  
 of the *silver* in the fire by drawing over the *Helm* as shall  
 be shewn.

Section.

2.

Why the *Sil-*  
*ver Calx* is  
 sweetned.

Now, when the water is drain'd from the *silver Calx*  
 then put it in a clean *Copper* half Bottle, and let the wa-  
 ter of it boil off and evaporate, that it may be very dry,  
 then put it in a *Crucible*, set it in the fire in a *wind-Oven*  
 or before the bellows, according as it is more or less :  
 make it not too suddenly hot, that if there be left by the  
*silver Calx*, any Spirits of the *Aqua fort.* that they may  
 evaporate before the *silver Calx* floweth, and the waste  
 of the *silver* may become the smaller, which waste is not  
 often small, and comes all from the spirits, for if they  
 could be retained in the *separating Glass* then little would  
 go off from the *Silver*.

After the melting together of the *silver* in the *Cruci-*  
*ble*, then *grain* it, or cast it in an *Ingot*, as you please,  
 this is the old manner of the *Goldsmiths* and common *se-*  
*parators* to cleanse the *silver* out of the *Aqua fort.* and  
 this *silver* which is thus settled out of the *Aqua fort.* is

3.

The content  
 of the Pre-  
 cipitated  
 Silver.

not

CHAP. not *fine silver*: but it worketh on the *Copper* from which  
 XXXIII. it is to be cleansed, and the stronger the water is in clean-  
 sing, the more it will touch, and mingle among the *silver*  
*Calx*, and it holds commonly a *Mark* of cleansed *silver*,  
 and this thus cast, holds near 15 *Loth* of *fine silver*.

Section.

4.  
 To bring the  
 blew water  
 to profit.

The settled *blew water* is to be used again with pro-  
 fit when you distil *Aqua fort.* and have put the prepa-  
 red stuff into a *Jug* (whereof *Iron ones* are best) then  
 put of this *blew water* two pound upon ten pound of  
*calcin'd stuff*; as soon as this is done, set the *Helm* upon  
 it, for it will presently go off it self, without any fire, and  
 lay the *Receiver* before, (without any sweet *Water*) lute  
 it well every where, and let it first go over the *flegm*,  
 then increase the fire till all the *spirits* are driven into  
 the water (as is said, when we spake of *burning* the *A-*  
*qua fort.*) then you may put this *blew Aqua fort.* into  
 a great *Culb glass*, which is cut off in the *Neck*, and lu-  
 ted over, and evaporate the moist *flegm* with the *fire*,  
 then it will become stronger, and so put it to the stuff in  
 the distilling.

But the *Aqua fort.* which comes of it, when the *blew*  
*water* is put upon the calcined stuff hath not so much *fe-*  
*ces* in cleansing and seething down, and is not so unclean  
 as other common *Aqua fort.* which is burnt of other  
*stuff*, because the *blew water* becomes *Metallick* by the  
*Copper* in the *precipitation*, and hath purified it self in the  
*Jug* or *Bottle*.

5.  
 To precipi-  
 tate *Silver*  
 in an earth-  
 en vessel.

Know also, That one may in a *glazed* or *earthen Vessel*  
*sel* (if it be good, and will hold *Aqua fort.* and *Oyl*)  
 cleanse the used *silvery Aqua fort.* and the *silver* precipi-  
 tated in it, namely, one must put such *Aqua fort.* toge-  
 ther with the clear water, (as aforesaid) mixed in the  
*glazed* or *earthen Vessel*, and lay in it red hot pieces  
 of *Copper*, and set the *Vessel* warm, then the *silver* will  
 quickly fall to the *Bottom*, but 'tis better to cleanse it

in

in a *Copper Vessel*, which may be done in a *coppery* or earthen vessel, yet in the cleansing of it, put iron *Lamins*, then the *silver* will come clean out of the water, as Experience teaches.

CHAP.  
XXXIV:  
Section.  
6.

*Iron Laminas in the Precipitation.*

## CHAP. XXXIV.

*How Aqua fortis drawn from Silver may be used again.*



THE Second manner of bringing the *Silver* out of *Aqua fort.* and to draw off *Aqua fort.* so that it may be used again for *Separation*, is a singular *ART* and *Dexterity*; 'tis thus, Put the *Silverish Aqua fort.* in a good *glass Bottle* which is *luted* over, and wherein *Aqua fort.* may be distilled, set it in one of the *Ovens* which are for distilling, and luted over (but in an *Athamor* is the best, and not so dangerous, as in a common *Oven*) let it be dry, then put the *silverish Aqua fort.* through a long glazed *Tunnel*, warm and not cold, into the *Bottle*, then set a *Helm* upon it, but not so strong luted over, lay the *Receiver* before, and lute the *Joynings* over so that you may take the *Helm* off again, (as you will hear hereafter.) And being thus set in, then dress the *Athamor*, and put fire and *Coals* in it. And by the *Instruments* (of which we have spoken above:) first give it a gentle fire, and let the *flegm* go over 9 or 10 *beats* or times (as before) and when the water or *flegm* is almost over, then shut all the *Instruments* on the *Athamor*, and take off the *Helm* again, and fill more *silvery water* through the long *Tunnel*, warm into the *Bottle*, (else it may break and do hurt) and put the *Helm* on again, and lay the *Receiver* before,

C c c

fore,

CHAP. fore, it but lute it not too strong (as at the beginning)  
XXXIV. and let the water go over again gently.

In this manner tis to be done the second and third time with the *silvery water*; and when you think it be *silvery* enough in the *Bottle*, or hast no more to put in, and the *flegms* are over, then take off the *Helm* again, and cast into the *Bottle* (to the *Silver* or *Stuff*) a piece of *Tallow* as big as half a *hazel Nut*, then the *Silver* will not ascend in the *Bottle*, put on the *Helm* again and lay the *Receiver* before it, and lute it all over well, and the best thou canst: then let the fire go on the *stuff* again, and make the fire fiercer (as you see convenient) At last, give it a strong fire, and force the *spirits*, near 12 hours, pretty well, yet not too high in the beginning, but by degrees increase it, that the *spirits* may go over with great force, and that the *Culb* may glow very bright, let it stand in the fire, near two hours, that the *Silver* may almost melt in it, then the *spirits* will come all into the water, and the *Silver* freed of them, for if they were not clean forced from the *Silver*, but remained by it, they would hurt it in the *casting* together, and draw it away; which may be seen apparently upon the *Coals*, that there will lye thick leaves upon it: They therefore who are ignorant of this, do many times work with danger, and great los of *Silver*.

Section.  
2.

One may also put the *silvery Aqua fort.* into the glafs *Bottle* luted over upon the *Athapor* in deep *Sand*, and draw the *flegm* (as now is mentioned) gently over, by which may be seen how it governs it self in the *Bottle*, and how the water decreaseth, and so have more care in putting in more water: finally, the *spirits* will be forc'd over, and the *Silver* be glow'd out in the *Bottle*, yet the last out-glowing is better to do in my mind, as above in the *Athapor*.

3.

When the water is thus drawn over, then let all be cold,

cold, and take off the *Aqua fort.* in the *Receiver*, which you may use again very well to separate, especially to the *Gold-proof*, and hath no need of further cleansing: then take out the *Silver* which was left in the *Glass*, and put it into a *Crucible*, and cast it together.

Some of the *Gold - Separators* have also this manner in drawing over the water, that they do add to the *silver Aqua fort.* in the *separating Bottle*, if it be six pounds, then one pound of the *stuff*, of the *Aqua fort.* (*viz.* of *Nitre*, and *calcin'd Vitriol*, as above is signified) and do not put it into the *Bottle* untill the water be almost gone over, and if the *spirits* begin to go over, they lute it again very diligently, and keep the *Fire* (as is necessary in burning of the *Aqua fort.*) that the *spirits* at last may come over too: and yet they do think that the *Aqua fortis* will receive a virtue and strength again from the added *stuff*, and is better for use in *separations*; then they force the *Silver* with the *Caput Mort.* (which yet is but little) into a *Crucible*, and cast it together: Whether now this way be better than the first? Experience must teach. So then you will have a good and right Instruction concerning the *Silver* and *Gold* separation in the *vwater*; and 'tis a compleat *vway* of separating; especially if one be provided *vwith* all things necessary to it.

Section  
4.  
Another  
way to draw  
over the  
Water.

---

CHAP. XXXV.

*How to separate Gold and Silver by Fusion.*



S it is an excellent piece of Art to separate *Gold* and *Silver* (in *Aqua fort.*) *viz.* The rich *Gold* containing *Silver*; so is also the *Separation* by *Fusion* upon the poor *Golden Silver*, where the *Mark* contains one penny and an half of

5.  
How to un-  
derstand Se-  
paration by  
Fusion.

CHAP. of *Gold*, to two or three drams, which is an handsome  
 XXXV. and profitable separation; so that I know no better  
 Section. way: but upon the rich *Goldish Oar*, that way is not to  
 be used.

2. But this separating by *Fusion* is to be understood thus,  
 That, because the *Gold* in the poor Content of *Goldish  
 Silver* is largely distributed, (through the Addition  
 of *Gold* in the *Fusion* in a little *Silver*) it may be brought  
 into a narrowness; namely, as when the *Goldish Sil-  
 ver* is thirty *Mark*, and one *Mark* contains a dram of  
*Gold*, then the thirty drams of *Gold* (which are in the  
 thirty *Mark* of *Silver*, will bring in two *Marks* of *Sil-  
 ver*, and then separate it in the *Aqua fort.* which is a  
 very great profit, because that one hath not need to re-  
 fine all the thirty *Marks* of *Silver*, and then to separate  
 them in *Aqua fort.*

3. If you have a *goldish Silver*, which is poor of *Gold*,  
 put it in a *Crucible*, let it flow, and grain it in the water,  
 and if it be but wrought *Silver*, and not fine, 'tis no-  
 thing: then weigh the *graind Silver*, and prove it up-  
 on fine *Silver* and *Gold*, how much it contains, that  
 you may keep this Account, that there remaineth no-  
 thing behind on *Gold* or *Silver*, and also canst certain-  
 ly know, how much the waste hath been in the *Silver* by  
 the separation.

4. After such proving and weighing, make the *grain* a  
 little wet again, and take to every *Mark* of *Silver*, four  
*Loth* of yellow *small beaten Sulphur*, put also the *grains*  
 wet into a *glazed Pot*, and put the *Sulphur* upon it, min-  
 gle it well together, and cover the *Pot* with a *Cover*,  
 then lute it well over, and make a gentle *fire* round  
 about: so that the *sulphur* may melt on the *grains*.

When this is done, Let the *Pot* cool, and break it in  
 pieces, then you will find the *grains* and the *Sulphur*  
 burnt very black together, beat it asunder, and take heed  
 that



that nothing of it spring away. After this put the CHAP.  
*grains* (thus with the *Sulphur* prepared) into a good XXXV.  
 Crucible, and upon the *Grains* put also a *Mark* of  
 wrought *Silver*, and half a *Loth* of *Copper*; but if it  
 be *burnt silver*, then take to every *Mark* two *lots* of  
*Grain'd Copper*, and set the Crucible in a *Wind Oven*,  
 which is made *taper-wise* with good and sound *Clay*  
 under the *Iron grate* before, towards the *wind hole*, that  
 if the Crucible should run over, yet the *scoria's* or *drofs*  
 of all the stuff may flow out of the *Oven* into the hole  
 under the *wind-hole*, then there is no need to gather it  
 so largely dispersed; and, that also the *Grates* may be  
 taken out and laid in again: After such Crucibles are  
 set in, then cover them with an *Iron-cover* very close,  
 let the *stuff* flow well, and when 'tis flow'd, uncover  
 the Crucible, and stir it well with a glowing *Iron hook*  
 of a finger thickness, and cast the *Silver* first down  
 with *grained Lead*, *viz.* that you may spread the *grain'd*  
*Lead* upon the *stuff* in the Crucible, in which the *Gold*  
 will cast it self down with some little *silver*, then put  
 also upon it some of the stuff (as is directed hereafter)  
 and stir it once with the *Iron hook*, then cover the Cru-  
 cible again with the *cover*, and let it stand thus a while  
 in the *stuff*, then uncover it again, and cast it down with  
*grain'd Lead* and a little *grain'd Copper*; do this three  
 times, and always use afterwards of the mentioned *flus*; Section:  
5.  
Precipita-  
tion, or cast-  
ing down.  
 but take notice, if you have in the *Crucible* 20 *Marks*  
 of *silver*, that you may not use of the *flus* (to three  
 times casting down) above 10 *lots*, and one and a half  
 of *grain'd Lead*, and 4 *lots* of *Copper*; for if you should  
 use more, then the *silver Regulus* might be too great.  
 Now when you have *precipitated*, or cast it down the  
 third time, let the Crucible stand with the *stuff* a long  
 time in good *flus*, then take it out of the fire, and cool  
 it, and beat it asunder, and of 20 *Marks* of *silver* you

D d d

will

CHAP. will find in the bottom, a *Regulus* of near 6 Marks  
XXXV. weight, or something lesser, in which there will be as much  
*Gold*, as in 20 Mark of *silver*.

Section  
6.  
When the  
Scoria's con-  
tains *Gold*.

7.  
When the  
Regulus is  
poor in  
*Gold*.

After the finishing of the first running or casting the  
*Metal*, then prove if you find the *scoria's* or dross up-  
on the *Silver*, and the *Silver* upon the *Gold*, and that  
if the *scoria's* doth contain *Gold*, set it again in a new  
Crucible, and let it flow, and use your casting with the  
*grain'd Lead* and a little *Copper* (as before) but not so  
much, unless the *scoria's* were rich in *Gold*, and then one  
useth much of the *grain'd Lead* and *Copper*, whereby the  
*silver Regulus* will become the greater, and the *Gold* will  
come better together; especially observe, that if much  
*Gold* be in the *silver*, then use at first most of the lower  
casting, that you may precipitate all the *Gold*, and when  
you have all the *Gold* in the two *Regulus's*, and do find  
that they are still too poor in *Gold*, that is, if you have  
not in the same a fourth, or at least a fifth part of *Gold*,  
by which the *Gold* in separating did not remain whole,  
then set in the *Regulus* again, *grain'd* and prepared with  
*sulphur* (as at the first time) and put the same ashed grains  
in a new Crucible, and spread a little *Copper* upon it,  
and cover it with *fluxs*, and put a cover upon it, and set  
it, thus covered, again into the fire in the *Wind-oven*,  
and let it flow well, then precipitate it again with *grain-*  
*ed Lead*, and use to every one of the castings the *fluxs*,  
(hereafter set down) and stir it well about with an  
*Iron hook*; now that the *silver Regulus* be not too great,  
and not so much (as that you need to separate it in the  
*Aqua fort.* in vain,) you may help it with the lower  
*stuff* or castings, whether the *Regulus* be great or small,  
(as above hath been demonstrated) and so deal also with  
the remaining *scoria's*, when such is yet rich in *Gold*; for  
by diligent proving one may always perceive whether  
the *Gold* be all in the *Regulus*, or whether some be yet  
be-

behind in the *scoria's*, that you may regulate your self CHAP.  
XXXV:  
accordingly.

When then you have done all things in the *Crucible* by precipitating and stirring about, and hast lifted out the *Crucible*, then cast the stuff out of the *Crucible* into an iron *Morter*, luted with *Tallow* and a thin *Clay*, and made a little warm (which I judge very good) for in such a casting the *Regulus* comes clean together; and as soon as this is cast out of the *Crucible*, then set the *Crucible* quickly in again in the *Wind-Oven* (especially if the *Crucible* be good, and, That you may trust to it) Put the stuff out of the *Morter*, and beat the *Regulus* from the *Scoria's*, and presently put the *Scoria's* in the *Crucible*, let it flow till it doth flow very easily, and cast it down again, and do it as you are instructed at the first, then put it again into the *Morter*, and cool it; Lastly, when all the *Gold* is cast down in the *Silver-Regulus*, then take the *Regulus* and burn it clean upon a *Test*, and grain it afterwards, either in the *bubling* water (as above mentioned) or cast it into an *Ingot* and beat it thin, then separate it in *Aqua fort.* as I have taught.

To this *separating* there doth belong good and sound 8:  
*Crucibles*, in which you at once may set in to separate near 50 *Marks* of *silver* or more, besides, I have seen a *Gold-separator* in *Saxony*, in such a *Crucible* hath set in, and cast down near an hundred *Marks* of good burnt *silver*, thus prepared with *sulphur*: But, because it causeth some fear to set in so much at once, therefore I judge it better, especially, if one cannot trust to the *Crucibles*, that one in one *Crucible* may set in no more than 50 *Marks* (except it were so much to separate) and then some more *Wind-Ovens* must be made, and more *Crucibles* be put in.

But for a true *Instruction* of the *Precipitation* (with 9:  
the before given manuduction) know, That it hath this

Con-

CHAP. Condition, *viz.* When there is put (after the former  
 XXXV. Directions) much *Goldish silver* with *sulphur* prepared  
 in a *Crucible*, and the *Gold* is cast down with the *Lead*,  
*Copper* and *Fluss*, then the *Gold* will *precipitate* or cast  
 it self from above, so you may with a little glowing draw  
 out of the *Crucible* some *scoria's*, but not the half part,  
 then cover the *Crucible* again, and precipitate it again,  
 and at last put the *stuff* (as I have mentioned before)  
 in an *Iron Morter*, by this way, I suppose, that the *scoria's*  
 of the *Gold* will be clean at once.

Section.  
 10.  
 Another  
 Way to pre-  
 cipitate at  
 once.

I must also further Instruct, That one may use upon  
 the poor *Goldish silver* (of which a *Mark* contains  
 but a *Heller* or *Penny-Gold*) this following Method of  
*separation* in the *Fusion*, first, that one must put into a  
*Crucible* of the *graind Gold*, with *sulphur* prepar'd as  
 above is taught) near 50 *Marks*, and let it flow well,  
 then *precipitate* it with *graind Lead*, and a little *Copper*  
 and when the *Precipitation* is right done, and the *scoria's*  
 with all the *stuff* cast together with the *precipitated*  
*silver*, and the *Regulus* and the *Gold* put in another hot  
*Crucible*, and again out of the same, into the first, and then  
 to cast it into an *iron Mould* of an *Oval* form, well wash'd  
 with *Clay*, and dry'd again, so that it may flow in bredth,  
 and the *silver Regulus* with the *Gold* may settle (yet broad  
 and thin) and then you will find, that in such casting that  
 all the *Gold* will give it self in the *silver Regulus* at  
 once, and you need not set it in the *scoria's* again, but it  
 will be clean and free at once: this now is an ingenious  
 Method, though I never used it: because the *silver Re-*  
*gulus* is so often cast through with the *scoria's*, and  
 doth spread among the *scoria's*, so that the *silver* may  
 the better catch the *Gold*, and take it to it self.

To such casting one must have a singular *iron-Instru-*  
*ment* made on purpose to open and close again with two  
 handles, the same is to be holden with thick *wet Gloves*  
 on

on the hands, and poured out to avoid the heat thereof; CHAP.  
 Every one may consider of this, but, I judge it most XXXVI.  
 convenient, the casting of the *Crucible*, as followeth.

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 CHAP. XXXVI.

*How the Scoria's or dross is to be made to Profit.*



THE remaining *silver* which in the *preci-*  
*pitating* comes not into the *silver Re-*  
*gulus*, but remains in the *scoria's*, you  
 may make to profit, and bring it from  
 it; only observe this, If one useth to  
 the *precipitation* much *Copper* and little  
*Lead*, then the *Scoria's* will become rich in *Copper*,  
 therefore to make such good again, requires much *Lead*:  
 But if you use to it much grain'd *Lead* and little *Cop-*  
*per* (as hath been taught in my former Instructions) then  
 the *Scoria's* will become rich in *Lead* and poor in *Cop-*  
*per*, and the *Gold* will precipitate never the less (after  
 this manner) into a *silvery Regulus*, which in the well  
 making of the *Scoria's* is very profitable, without any  
 great damage to the *silver*.

Therefore make it thus, If the *scoria's* be 30 *Mark*  
 which you would make to advantage, Prepare a very  
*flat Test*, of good wash'd *Ashes* (as I have taught in the  
 first Book of the *silver* work) set it before the *Bellows*,  
 that it be not too strong, let it be warm, and then put  
 upon it 15 pounds of clean *Lead*, blow it gently, and  
 when it begins to drive, then put continually one piece  
 after another of the *Scoria's* into it, so the *Lead* takes the  
 Content of it to it self, and the *Sulphur* is blown off  
 from the *Test*, also the *Scoria's* doth not stick so much  
 in the *Test*, because 'tis poor in *Copper*: But if there

E e e

be

Section.  
 I.  
 The first  
 way.

CHAP. be not enough of Lead, then you may add somewhat  
XXXVI. more, till all the *scoria's* be suck'd in: then drive it up-  
on the *Test* clean off, so you will find, that not much  
more than a *dram* is gone off from the *Silver* in the *sepa-*  
*ration.*

Section.  
2.  
Another  
way.

Also, one may put again all the *Scoria's* into a *Cruci-*  
*ble*, and let it *flow* in a *wind-oven*, and when 'tis *flowed*  
very well, the *silver* (with filed *Iron*, or *Iron-Scales* and  
*grain'd Lead*) is to be *precipitated*, stir it well about,  
and with the filed *Iron* follow it so long, till the *scoria's*  
doth touch no more the *iron Hook*, then lift it out of  
the fire, and let it cool well: In this *precipitation* (with  
the *Iron*) the *Sulphur* will loose its strength, and lets  
fall the *Silver*, and thus with this *precipitation* the  
most part of the *silver* settles it self in the *Crucible*,  
which with the remaining *scoria's* is easy to be brought to  
profit, especially because it is rich in *Lead*.

5.  
The *Scoria's*  
is mallea-  
ble.

Now, because I am just come to the *scoria's*, I must  
(in kindness to the *Reader*) mention somewhat of its rare  
nature; for first, When the *Scoria's* is cast into an *In-*  
*got*, while 'tis yet hot, it may be hammered and beaten,  
as one pleaseth, like *Lead*.

4.



Then one may cast *figures* and *medals* which will look  
like *glassy Oar*, and if one cast forms of it, and turn it over,  
and lay it upon a gentle coal-fire, till they are warm, then  
set it over a coal-fire, and the *silver* will glow out of it, as  
if it grew in the *Myne*, and, 'twill look lovely and fair:  
and this I signify, that any one may use it at their plea-  
sure, and, like an *Artist*, know what is to be done there-  
with.

CHAP.

## CHAP. XXXVII.

*How to make a Flux for Precipitation.*

**F**LUSS is made by taking *Litharge, Glass-gall,* and *melted Salt,* of each a like quantity, small beaten, and *filed Iron,* and a like quantity of *graind Lead,* this *Flux* or *fluible Composition* maketh the *scoria's* deft, so that the *Gold* will settle it self the *easier,* and *precipitate* gently, and not suddenly; and if you will use it, you may do it the more safely in the *Precipitating* with the *Graind Lead* and *Copper,* lest the *silver Regulus* be too great.

So you have a clear Instruction how you shall do with the *Separation* in the *flux* all in all, which is well to be observed, for it requires a more singular and exact diligence in the *Aqua fort.* than in other separations, as you will finde.

Concerning the old used *Crucibles* and *Tests,* which come from such *separations,* they are to be kept together, for they are not without *Silver,* and to make such serviceable, set one of the old *Crucibles* in the *Wind-Oven* full of *Lead,* let it drive gently, and lay the pieces of the used *Crucibles* one after another in it, then the *Lead* will draw all that remains of the *Scoria's* to it self, and becomes as wash'd: and you may use the same *Lead,* in stead of other *Lead,* or add but a little of it upon the *Test,* and then you may make it be profitable; for the more you keep all things together the less is the damage of the *Silver:* but all is to be *swept* together, and wash'd at once alike, and then melted for your advantage.

Section.

1.  
How to  
make it.

2.

Separation  
in the flux  
requires di-  
ligence.

3.

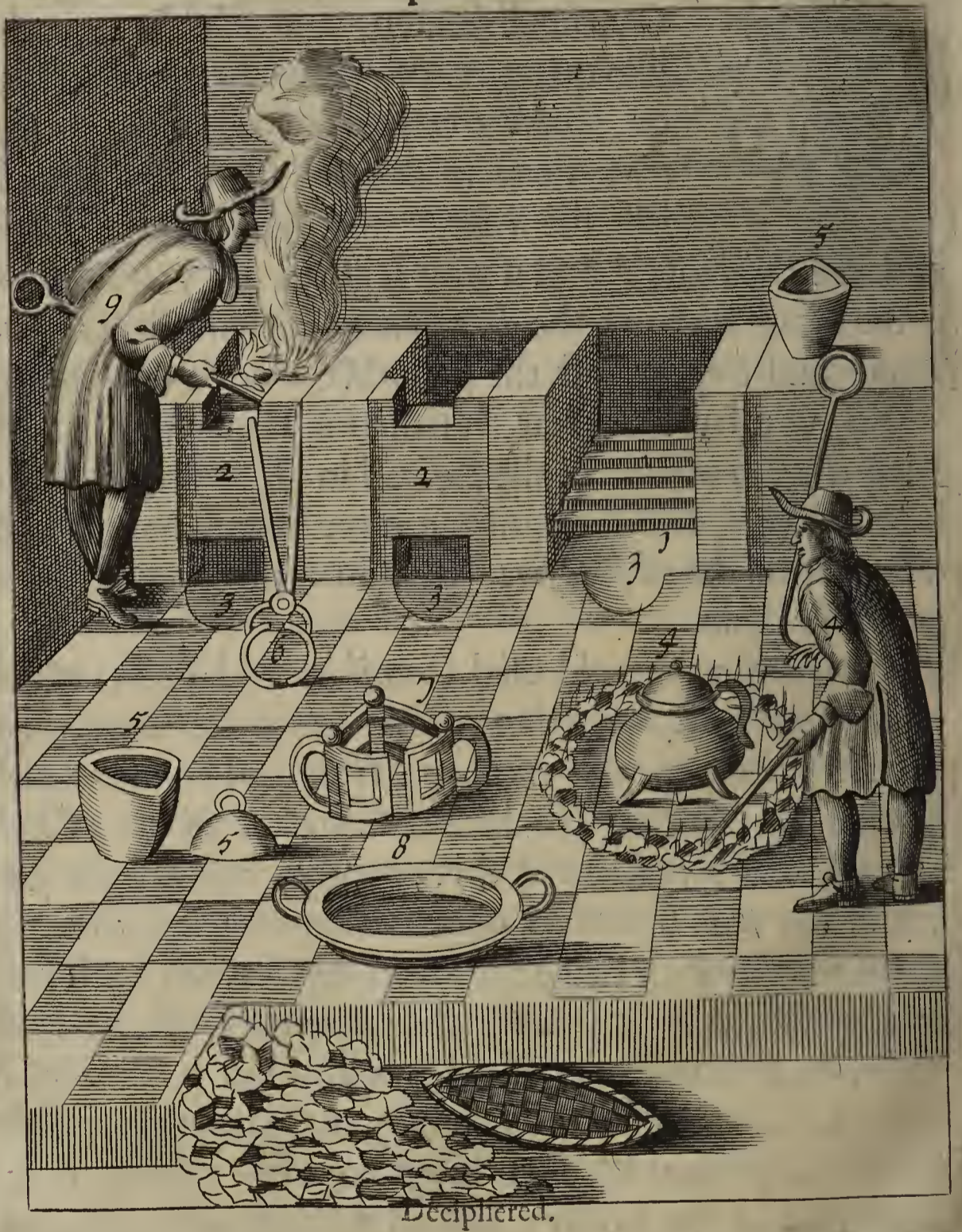
The use of  
the Test.

And

CHAP.  
XXXVII  
Section.  
4.

And, when in this *Separation* a *Crucible* runs out, (as it oft hapneth) then is this *stuff* and *scoria's* (because 'tis heavy, and remains in the water) like another *Silver* to be search'd and found out. But, that you may see the *Wind-Ovens* (with all the appertaining *Instruments* and *Vessels* to this *Labour* severally formed) I have in the following *Sculpture* for this end delineated them.

Sculpture XXV.



1. The inward part of the *Wind-Oven*.
2. The outward part prepared.

3. The



3. The holes next the wind-holes.
4. The Pot in which the Sulphur and graind-Mettals are prepared, with a fire under it, and a person attending it.
5. A single Crucible, and a cover to it. 5. 5.
6. The iron Tongs, by which Crucibles are put in, and taken out of the fire.
7. The Instrument in which the Crucibles are to be set.
8. The iron Vessel into which the stuff or melted matter is to be cast.
9. The person attending the Wind-ovens.

CHAP.  
XXXVIII

## CHAP. XXXVIII.

How to make good and sound Crucibles for separating the Flux.



BECAUSE there must be good and sound Crucibles to the Separation in the Flux, therefore I will give here a little Instruction how they are to be made: The chief and that of most concernment is good Clay, that holdeth well in the fire, of which may be made good Crucibles.

When you have such Clay, let it be well dryed in the Sun, beat it small, and sift it through an hair sieve; put among it the tenth part of small beaten flint-stones, which is burnt and wash'd: and half so much small ground Chalk, or in stead of that Glimer or Tallow, or in stead of these burnt Water-flints small grownd, mingle all these well together, and moisten it a little; work it well together with your Feet, and after with your Hands: then take smooth pieces of Pear-tree, or other strong wood, suitable to the bigness of the Crucibles;

Section.  
1.

2.

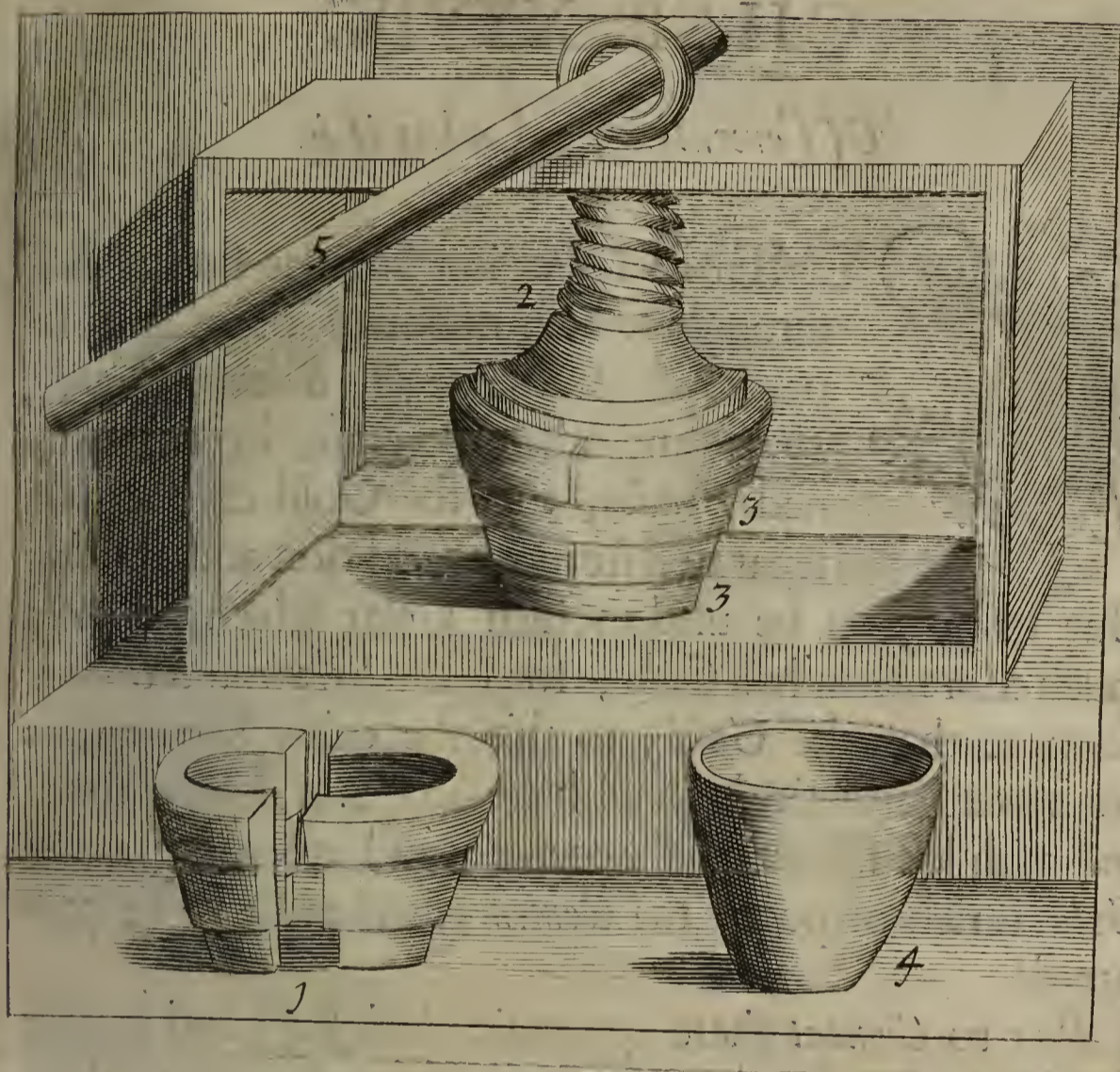
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bles;

CHAP. XXXVIII  
bles; which may be taken in two parts afunder, on which may be laid two *iron Rings* or moulds, beat and press the *Crucibles* into the same, but let the upper part of the *Crucible* be first well oyl'd over, that it may the better go out. After the preparation of the *Crucible*, let it be dry in the *Frame*, then the *Crucible* will go out whole, for if the lower part be oyl'd, then the wet *Crucible* might with the upper part, lift up it self out of the *frame*, and hardly remain whole; or, take one part of *Potters clay*, a fourth part of *good Clay*, and a fourth part of the above mentioned *flint-stones*: but you must observe whether the *stuff* or *Clay* be too fat or dry, and those Portions which you take unto it, and so you will have good *Crucibles* which will not fail.

Section.  
3.  
Some use *Crucibles* having three feet, below, upon which stand the *Ovens*, and need not be set upon a foot of the *Crucible*; such *Crucibles* I much esteem of, for the heat may easily come without hindrance of the thick bottom, that the *silver* or *Mettal* in it, may become sooner hot, than in such *Crucibles* which must be set upon a thick foot, they stand also and hold better and longer in the fire than they which are set upon particular feet of *Crucibles*, especially when the feet, as well as the *Ashes* of the *Crucible* are not so very dry, then it draweth the bottom of the *Crucible*, and the *Moistness* to it self, and cracketh it very easily, and by this may be seen that out of a common three-footed pot (used for boyling and casting *Copper* and *Brass*) in an hour and a half you may alwayes make warm and cast a *Fluss* of 12 pounds in a *Wind-Oven*; yea, one may well cast some *Fluss* out of it, especially, if one have tongs to it, to lift the *Pot* out of the *Fire*. I was willing to mention this as an *Instruction*, and the form of such *Crucibles* you will find in the following *Sculpture*.

Sculpture.



Deciphered.

1. *The lower part of the frame of a Press, for making Crucibles.*
2. *The shape of the whole Press, and how the Crucibles are to be forc'd under it.*
3. *The iron-Rings or Hoops about the Frame.*
4. *The shape of Crucibles to be made in the Press.*
5. *The Handle by which the Screw of the Press is to be turned.*

## CHAP. XXXIX.

*Of Cementing, and what it is.*Section:  
1.

**C**EMENTING is a singular fine *ART* through which one may draw and separate from the *Gold, Silver, Copper, Brass,* and other *Metals,* by a moistened *Powder,* that the *Gold* may remain separated from its *Addition* and *Allay:* But 'tis only to be used to such *Gold*s which are not much more than half *Gold,* for if the *Silver* and *Copper* be more than the *Gold,* to this the other *Separations* are better, and 'tis done with the same in a shorter time, and with less labour and expence: and according as the *Gold* is rich or poor, the *Cements* is likewise to be prepared.

2.

But to *Cement* there appertains such *stuffs* and matter as will work upon the *Silver* and *Copper,* because of their sharpness, and consume them as a sharp *Salt species,* among which is to be taken *Verdigrise,* calcin'd *Brass,* and such like, that they may give a fine and grateful colour to the *Gold,* or else *Lapidem Hematitem, Crocum Martis, Tutiam,* or calcined *Vitriol;* which *Ingredients,* how to be put into the *Cement,* is left to every ones *Liberty,* but he must observe, that he take nothing which is contrary to the *Gold,* or that may make it unclean and do hurt. The *Powder* of *Tile* is to be used in the *Cement,* that it may attract what the other *Ingredients* do scarify, and loosen, as *Silver* and *Copper* from the *Gold* with their sharpness and moistness, which else would stick and hang about the *Gold,* whereupon the *Gold* becomes fine and clean. Therefore

Therefore I have set down some *Cements* which I have used and found very good; But, because in this *Art* of *Cementing* there is necessary a particular *Oven*, which holdeth fire long, therefore I shall first mention how it is to be made, with its *Form*.

CHAP.  
XL.

CHAP. XL.

*How the cover'd Oven for Cement is to be made.*

**I**F one hath much to *Cement*, there is no better way, than to prepare such an *Oven* as in the following *Sculpture*; and although there may be other *Cement Ovens*, yet I conceive that this is the most profitable; for it will hold about 24 hours such a continual fire, that there needs not any attending of it, and it is done thus: Make a square of *Tile-stones*, the inside an Ell wide, and an Ell-high, to the edge (where the *Oven* is to be tapering) and then from the same edge to the Tower of the *Athbanor* is to go half an Ell high, and that the Tower of the *Athbanor* be an Ell and a half or two *Ells* high, and the inside an Ell and half wide, and so the whole *Oven* three *Ells*, or three and a half high; and there must be on the foreside of the *Oven* two *Mouth-boles*, the lower a third part of an Ell long, and a sixth part of an Ell high, through which the wind may go, but the upper an Ell and half a quarter wide, and so high; and by the same *Mouth-hole* there must lye (in the inside of the *Oven*) an *iron Grate*, with an edge, as in the next *Sculpture* marked with *Figure 3.* and out of the same *Grate*, before the *Mouth-hole* in the *Oven*, an earthen plate upon which a *Muffle* as high as the *Mouth-hole* is to be placed, and then

Section.  
1.

G g g

under

CHAP. XL. under it the prepared *Cement* comes to stand pure and clean, or else the *Pot* with the prepared *Cement* is to be set in it without the *Muffle*: you must also make four *smoak-holes* upon every side one, as in the next *Sculpture* at *figure 4*.

Section.  
2.  
Concerning  
the *Cement*  
oven.

Now, if you will *Cement* in the *Oven*, and the *Cement* is set in, then put in above in the *Athamor* (or *Tower*) live *Coals*, and fill it after with dead *Coals*; then cover it so as no *Air* may go out of it, only leave the *Mouth-hole* open (marked with the *Figure 1*.) and the *air* or *smoak-hole*, (noted with *figure 2*.) that the fire may begin, and have air; then shut all the other *air* or *wind-holes* close, and let open only the uppermost hole of the *Tower* near the *cover* (noted with *figure 5*.) About the bigness of a little finger, that the *Cement* be not too hot, and not to suffer any damage.

In such an *Oven* you may keep a *Fire* 24 hours, (as abovesaid) that there needs not much waiting on it, nor casting fresh *Coals* into it, for the *Coals* in the *Athamor* will follow one another, and keep the fire all the time in due heat (as you please). But if there be cause to continue the heat longer than 24 hours, then put more *Coals* into the *Athamor*, and so keep the fire as long as is needful.

Now, concerning the *Cement ovens* which have been used formerly, those I leave in their esteem; and when you have try'd both, the *Difference* will be found.

But if one cannot quickly have such an *Oven* to the *Cementing*, then put the prepared *Cement* between *Tile-stones* in a clean *Coal-fire*, and let it glow its time (as hereafter) but so that it may not melt. Thus, you may do all the *cementing*: but be diligent, and careful of the *coals*: Now the form of the *cement Ovens* may be seen in the *Sculpture* following.

Sculpture.



Deciphered.

1. *The Athapor and lower Mouth-hole.*
2. *The upper Mouth-hole.*
3. *The Edge upon which the iron Plate doth lye on the iron Grates.*
4. *The Registers or Air-holes above the Grates.*
5. *The little air-holes near the top of the Athapor.*
6. *The stopples for the Registers or air-holes.*

7. *A*

- CHAP. 7. *A Test fitted for the Athanor.*  
 XLI. 8. } Cement Pots.  
 9. }  
 10. *An hook to stir the Coals.*  
 11. *A person that attends the Furnace and works.*

## CHAP. XLI.

*How Rhenish Gold is to be Cemented.*



Section.  
 1.  
 How to pre-  
 pare it.

2.  
 The first Ce-  
 ment Pow-  
 der.

**R**HENISH Gold (to cement it either in *Ingot* or *Plate*) must be beaten thin, (the thinner the better) and cut it in little pieces, as broad as *Crowns*. But if it be *Rhenish Guilders* which you would have cemented and clean, then beat them a little thinner, but if there be not much need of that, then beat them whole: Upon such beaten *Gold*, or *Gold Guilders* the *Cementing* is to be done thus, Take 16 *Loths* of powder of an old *dry Tile* (not too hard burnt, neither too sandy) then 8 *Loths* of *Salt*, and 4 *Loths* of white *Vitriol*, grind these *Ingredients* all together small, and moisten them with *Urine* or *sharp Vinegar*, like *Copel Ashes*, so is the *Cement powder prepared*.

Then take that which you intend to cement, glow it first in the fire, and let it be cool, then spread some of the *Powder* in a *Test* or *Pot*, which is to be of an equal wideness, a finger thick, and lay the *Gold* (which you must first moisten in *urine* or *vinegar*) upon the *cement Powder*, one piece near the other, as broad as the *Test*, then spread upon it again some of the moistned *Cement Powder* half a finger thick, and upon it (as now is mention'd) the *urine moistned Gold*, lay one lay upon another, until the *Test*  
 or



or *Pot* be full, cover it over with the *Cement* powder CHAP. the thickness of one's Finger, that one may see the *Gold*: XLI. then put over it another *Test*, or cover very well luted, that no vapour or spirits may go out; then set the *Test* (or *Pot*) with the *Gold*, and cement, thus prepared, in a *Cement Oven*: and observe, that it may stand in like heat 24 hours, and glow brown, that the *Gold* may not flow in the *cement* (to prevent *Dammage*) for, if it should flow in the *Cement*, then the *Silver* and *Copper* which the *Cement* hath extracted, may suck in the *Gold* again, and thereby all pains of beating and *Cementing* will be in vain.

Now, when the *Gold* hath stood in the *Cement* 24 Section: hours, then shut the *Oven* every where, and let it be 3. cool, then take it out and open it, and wash the *Cement* This second *Powder* off with warm water, then the *Gold* will be Cement. found very near 23 *Carats* on the *Content*; and if you will have it higher *Gold*, then do the *Gold* over again with another singular *fresh Cement* (to which take 16 *lotbs* of *Tile-powder*, and 8 *Loths* of *Salt*, and 4 *lotbs* of *white Vitriol*, one *lotb* of *Salt-petre*, and one *lotb* of *Verdigrise*) and let it cement again (as before) 24 hours, do this till the *Gold* is very clean, and high to your delight: It is done well in a few hours, but when you have spare time, let it stand the 24 hours, 'tis then better and surer; But, how much properly every *Cement* makes the *Gold* better, the proof will shew.

If one lay *Rhenish Guilders* whole in the *Cement*, and 4. cement it, then there will not only come *silver* off from it, To cement and *Copper*, but it will come to be of the *Content* of the Rhenish Gil- *Hungarish Gold*, yet they retain their Impression and ders whole. *Circumscription*, only they become lighter as much as *Copper* and *Silver* have been in them: in this manner is to be cleansed through the *Cement*, a light *Gold*, in an *Hungarish Content*: only observe, if you have according to  
H h h your

CHAP. your pleasure made it higher through the Cement, then  
 XLII. you must boil the *cemented* Gold at last in clear water  
 XLIII. or lye, until all the *sharpness* come off from it, so it will  
 become cleaner, than by washing only.

This you must do with all Cements, so you will receive *Gold* as high as your desire is.

## CHAP. XLII.

*Another Cement upon light or mean Gold.*

Section.  
1.



PON light Gold alwayes the first *Cement* must be made of two parts of the powder of *Tyle*, and one part *Hungarish*, or other *Salt*; but to the other shall be taken two *Ingredients*, viz. of *Viridigrise*, *Lapis Hamatites* and *calcinced Vitriol*, as much of the one as the other, and *Urine* boiled very dry and small beaten, thus the *Gold* will become high and fine.

## CHAP. XLIII.

*A good Common Cement for all Golds.*

1.  
The Ingre-  
dients.



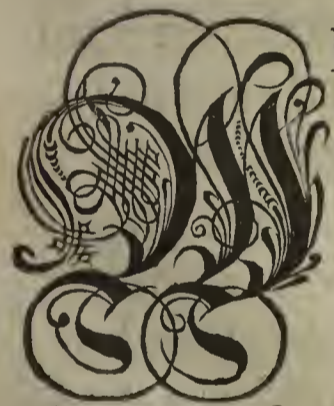
AKE fourteen *lots* of *Tyle*-powder, 4 *lots* of *Hamatites*, one *lot* of *Crocum Martis*, one *lot* of *Verdigrise*, six *lots* of *white Vitriol*, and three *lots* of *Salt-petre*; Grind them all small, and the *Gold* with *Urine* moistned, and as before after the first *Cement*, to be *cemented*, and it gives a very fine *Gold*: Some use among this and other  
*Cements*

*Cements, Antimony and Sal Gemma*, this is left to every ones freedom : but Reason tells us, That if one *cement* the Gold right, as it may be, with 2, 3 or 4 of those Ingredients, and, that it is not needful to take above 7 or 8 of them, for, I have found it so : But, if you will do something more for the *Graduation* sake, it may be done, for it is certain, That every Gold which is very clean and high, brings his right *Gold-Graduation* and fine *natural* right *Gold-colour* with it self, but one may give the Gold (besides this) a high colour, that it may excell with this *colour* all other high *Gold*s. But in my Judgment, the same looks not so lovely, as a Gold which hath with it self a high fine *Colour*.

CHAP.  
XLIV.

## CHAP. XLIV.

### More Instructions for Cementing.



WHEN the *Gold* is *cemented*, and almost clean then some do use this Method, they put the same *Cemented Gold* into another *Cement* made of four parts of the *Powder* of *Tile*, one part of *Sal Armoniack*, one part of *Sal Gemma*, and one of *Salt*, all small ground together, and the *Gold* moistned in *Urine*, and put it into a *Cement Test* (luted as above) and clarified 12 hours : until the *Gold* becomes very clean : But why they use *Sal Armoniack* among it (which useth to touch the *Gold*) I cannot tell : therefore know, That it will not do it *raw*, especially when 'tis mingled with the watery *Salt*, (as here) but it purifieth rather that no other Metal (which is made loose of the other *Cement*, and yet partly doth hang on it, and in it) may remain.

Section:  
I.  
The Composition.

Then

CHAP.  
XLIV.

<sup>2.</sup>  
Another  
way.

Then some when they have much to *cement*, and yet are not willing to beat the *Gold thin*, they put it in a Crucible, and grain it in a water, and when it falleth thin and hollow, (as is mentioned in the *silver* work) they mingle such Grains with the *cement* Powder, and cover it also with it, that the *graind Gold* be not seen, and set it in, as they have done with the *Cement* before, and when it hath stood its hours, they make the *Grain* clean from the *cement* Powder by washing it with warm water, and set it in again, with the fresh *cement-Powder*. But because the *Grains* cannot fall all alike thin in casting, but some are thicker than others, which the *cement* cannot quite bite through, like the thin *Grains*, and then they grain it (when it hath been twice thus in the *Cement*) once more, then it will come among the other again, and the *cement* will work the better, and purify the *Gold*.

Section:  
<sup>3.</sup>  
To cement  
the *brickle*  
*Gold*.

This manner of *cementing* is best upon the light *brickle Gold*, which suffers not it self to be beaten. And though the *Gold* must be *graind* once or twice (yet tis better, first to make the *Gold* deft with much pains) and then to beat it thin: Therefore when the *brickle* grains are set in, once, four or six times, and hath stood in the *cement*, and is become clean, and of an high content, to thy desire, then is it deft enough: For all Brittleness and uncleanness of *Tin* or *Brass* the *cement* draws out of the *Gold*; And the *Copper* and *Brass* is much sooner and better drawn out of the *Gold*, through the *cement* than the *silver*. In this *cement* the *Gold* suffers a great damage, for the *silvers* will still contain the *Gold* which is melted out of the *cements*.

<sup>4.</sup>  
Another  
manner.

One might also cast the *clear* or *light Gold* in thin leafs (like as is usual in the *coin-works* in casting of small Money) and then to lay the cast *Ingots* in the *cement* in pieces, which when they are *cemented* twice, and so  
be

become more deſt, then one may beat them a little thinner, and cement them, and follow them with beating and cementing till the *Gold* becom's very deſt, and ſo you may beat it thin, and then it will become high enough in the *Content*. By this way the *Gold* may be better holden together, and the *Graind* may be brought out of the *Cement*; and will not go into the *Gold*, nor will any *Gold* come into the *Cement*.

When the *Gold* is thus made pure by the *Cement* and brought upon the *Content*, as one would have it, then make it clean from the *Cement* (as above) and do a *Crucible* over with *Borax*, put the *Gold* in it, and let it flow, force it off from the *Bellows* or in a *wind-Oven*, untill it appear very bright, and holdeth the blow, ſo is it deſt, then lay a paper anointed with *Wax* or *Tallow* upon it, and while it yet burneth, caſt it in an *Ingot*, which is done over with *Wax*, and is warm, then quench the *Gold* in *Urine*, ſo you will have *fine Gold* and *deſt Gold*.

You may alſo be instructed, if you have quite done cementing, and haſt much of the uſed *Cements* in which is the *Silver*, and Addition which hath been in *Gold*, then melt the ſame *Cement* with other ſweepings which is not *Goldiſh* through a *melt Oven*, and bring it to profit, ſo that the *Silver* which the *Cement* hath ſuck'd in out of the *Gold* may be made again to profit, for the *Cement* takes no *Gold* to it.

But, as for the *Cement* of which the *Philosophers* and *Alchimists* do write, by which one may change *Copper* into *Silver*, and *Silver* into *Gold*, thoſe I leave to their worth, for ſuch belong not to theſe *Cements*. For in my Books I write nothing elſe, but what is natural and approved, upon which one may truſt, and not labour upon a vain hope.

CHAP.  
XLV.

## CHAP. XLV.

How to graduate Gold.

Section.  
1.  
The first  
way.2.  
A very  
good Ce-  
ment.

**RADUATING Gold** ( that is to give the *Gold* a higher Colour above its fine natural Colour, to become more red, its right high Gold colour) is to be done thus: take good *Rhenish Gold*, add to it as much *fine Copper*, cast it together, beat it thin, and *cement* it off again that it may have its first *Gold-weight*, then set to the *Gold*, and so much pure *Copper* again, and cast it together, beat it thin again and *cement* it the second time, and so do untill the *Colour* pleaseth thee: By this *Process*, some think the *Gold* may come to such an high *Colour*, that it will exceed the *Copper* in colour, if it were thus cast 30 times with the *Copper*, and cemented off again, only that one must use the *Cement* (written hereafter) which is much better than a common *Cement*: namely, Take the *Powder* of *Tile* which is well dryed in the *Sun*, and *common Salt* once dissolved through the *Filtre*, purified and once glowed, make out of every one, a part of small powder searfed through a hair *sieve*, and then put in *Roman Vitriol*, first rubified, as followeth: Take good *red Vinegar* distilled through an *Alimbeck*, and in this dissolve the *Vitriol*, and purify it through a *Filtre*, fair and clear, and let it evaporate upon warm *Asbes* till you find it fair, then put it in a new *Pot*, set it betwixt *Coals*, and stir it about with a little wooden stick, till it becomes blood *Red*, let it be cool, and grind it small, and then 'tis rubified: also take *Verdigrise*, and dissolve it in distilled *Vinegar*, and distill it by *Filtration*, and let it evaporate,

evaporate, and glow it, as you have done with the *Vitriol*: Take also so much *Sal Armoniack*, dissolved in red *Vinegar*: and of these now mentioned powders, take of one so much as of the other, mingle them well, and sprinkle them with the *Vinegar* wherein the *Sal Armoniack* was dissolved, so is the *Cement* prepared.

Some do write, That one may mingle the *Gold* with the *Copper*, alike in weight, and then to cast it through *Antimony*, and then blow it off and purify it, and again with the *Copper*, and so mingle and cast it through so often till the *Gold* receives thy desired high *Colour*: I believe also, That if one can have good *Antimony*, that it will give the *Gold* an higher *Colour*.

But the common *Graduations* may be done thus, That one may make a Powder of two parts *Copper*, and one part of *Sulphur*; Calcine them together till no *blew flame* goes off them, so you have a *Graduation Powder*, grind it: and when this Powder is used, the *Gold* will be of a little lighter *Content*.

Of such high *Graduated Gold*, and how to be used, many of the *Philosophers* do write, but 'tis nothing to this, for in my Judgment, when 'tis indifferently brought high, it may be most convenient for the *Goldsmiths* to use for *gilding*, that they may reach the further with it, because of the *Colour*, yet it is free to every one to make Experience of it.

CHAP.

XLV.

Section.

3.  
Another  
Sort.

4.

5.  
How the  
Goldsmiths  
may Gild.

CHAP.

CHAP.  
XLVI.

## CHAP. XLVI.

*How to make bricke Gold, deſt.*Section.  
1.

HIS Labour hath formerly been esteem-  
ed a ſingular *Art* of the *Coin-workers*  
and *Goldſmiths* and other *Gold-workers*,  
and indeed it is a fine and uſeful *Art*, not  
to every one known, and is neceſſary to  
be know to all *Goldſmiths*: For there  
are ſeveral wayes to make the *Gold deſt*, only one is  
more eaſy and better than the other. And I will here  
ſhew ſome wayes, which partly I have tryed my ſelf,  
and out of which every one, according to his occaſion  
may take Inſtruction, to uſe that which will be moſt con-  
venient for him.

2.  
*Hungariſh  
Crowns or  
Rheniſh  
Gold.**Salt Petre.**Calx viva.*

When you have the bricke *Gold* (it may be *Hun-*  
*gurian Crowns* or *Rheniſh Gold*) and wouldſt make it  
*deſt*, then do it thus: Firſt, Caſt the bricke *Gold* into an  
*Ingot*, then put it in a *Crucible* in a *coyn'd Oven* or be-  
fore the *Bellows*, and give it a ſtrong fire, and obſerve  
when the *Gold ſweateth*, and will ſoon flow: Then  
caſt good purified *Salt petre* upon it, ſo the *Gold* will  
burn, becauſe of the *Salt petre*, and quickly flow, and  
as ſoon as it flows, then the *Salt petre* will quite cover  
the *Gold*, then you muſt not drive it hard, ſo as you may  
not ſee the *Gold* under the *Salt Petre*, but pour it out  
under it, into an *Ingot*, luted with *Wax*, ſo is it *Deſt*;  
ſome uſe among the *Salt Petre*, *Calx Viva*, it doth the  
ſame, and the *Gold* becommeth *deſt*.

But if it ſhould be neglected, that the *Gold* in the ſet-  
ling in, might flow in the *Crucible*, before the *Salt Petre*  
were caſt upon it, then pour it out again into an *Ingot*,  
and



and put it in again, for else it will not be smooth and *deft* CHAP. XLVII.  
 although you do cast much *Salt Petre* upon it; but if  
 the *Gold* (as in the *Rhenish Gold* sometimes hapneth)  
 were not too brittle, that it at once doth not become very  
*deft*, then put it in the second time, and it will become  
*deft*, although there may be *Brass* in it.

You may know also, That when the *Gold* shall be Section.  
 driven too hard with the *Salt Petre*, and that it appear- 6.  
 eth and may be seen under the *Salt Petre*, then it is not  
*deft*, for the *brittleness* driveth it self again out of the  
*Salt Petre* into the *Gold*, therefore 'tis to be observed,  
 That the *Salt Petre* be cast upon it in the right time, and  
 also the *Gold* cast out again, in the right time, and so  
 you will have *deft Gold*.

## CHAP. XLVII.

*Another way to make Gold, Deft.*



CONCERNING the good *Gold*, or of  
*Hungarish Content*, if the same be brittle, <sup>1.</sup> By a flat  
 Test.  
 then take a flat *Test*, made for it on pur-  
 pose, that the *Gold* may have room up-  
 on it, Lute it over with pure *Littarge*,  
 and set the *Gold* upon it (yet you must  
 not set in it, at once, above two *Mark*) and set the *Test*  
 with the *Gold* before the *Bellows*, and drive it; But if  
 it will not endure the blowing, then add a little *Ball* of  
 good clean *Lead*, and drive it again, until it will endure  
 the *Bellows* and become *deft*, then put it in a *Crucible*,  
 and cast it into an *Ingot*, and quench it in *Urine*, and so  
 the *Gold* will be *deft*, one may also cause the *Gold* to

K k k

flow

CHAP. XLVII. flow with *fresh coals*, upon a *flat Test*, and then drive it, and this also doth well.

Section.

2.

To bring the Gold clean out of the Crucible.

But if you will cast such *Gold* (if it be good or light) out of the *Crucible* on a *Plate*, then take a *Paper*, and dawb it over with *Wax* and *Venetian Soap*, cast a little piece upon it, and while it yet burns, lift the *Crucible* off, and cast the *Gold* out under the flames, and so it will remain warm and have no scum, and cast it self clean, that nothing may remain hanging on the *Crucible*.

3.

When the Gold is brickle by an evil Vapor.

If a good or *Hungarian Gold* becoms brickle, because of an unclean *Fire* or bad *smoak*, then it may also be made *deft*, upon a *flat Test*, with the *Bellows*, or one may, when 'tis cast into an *Ingot*, lay in one of the before written *Cement Pouders*, an hour or two, and so it will become *deft*.

Or melt it with good *Venetian Borax*, and drive it before the *Bellows*, till it endureth the blowing, or in defect of all these *Ingredients*, if a *Gold* be only brickle by an evil *smoak*, then make it *deft* with *Venetian Soap*, and let the *Venetian Soap* burn upon the *Test*, then there will remain a *gray Pouders*, which you may use instead of the *Borax*, and so the *Gold* may be cast clean.

4.

Mercurium Sublimatum.

Some also cast upon the *Brickle Gold* in the *Fluss*, *Mercurium Sublimatum*, and blow the *Gold* with it, and it will be *deft* (which is a good way) others on the contrary use *yellow Sulphur*, but the *Gold* must be cast out soon after it, or take *Antimony*, and cause it to flow in a *Crucible*, and when it is flowing, then they cast as much *Sulphur* and *Argol* in it, and let it stand so long in the fire, till it becoms a *Glass*, and with this *Glass* the brittle *Gold* is to be driven *deft*.

5.

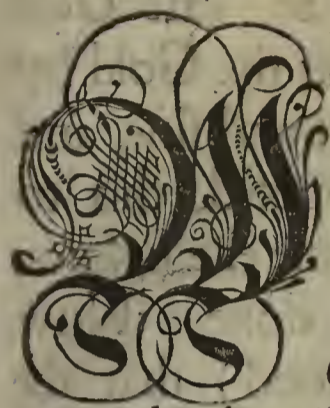
Sulphur, Antimony, Glass.

6.

Some of the *Goldsmiths* use a *Pouders*, made of *Brass* calcin'd and *Verdigrease*, but it should not be so, for both these species are *Metallish* and go in the *Gold*, by which it becoms higher or meaner.

CHAP.

## CHAP. XLVIII.

*How to make Gold Deft upon the Copel.*

**W**HEN you have good *Gold*, set it with *Lead* upon a *Copel*, and let it be very hot that it may stand pure and clean upon the *Copel*, but before it hardens upon it, put it with the *Tongs* gently on the *Copel*, that the *Gold* may simmer and quiver; do this till it becoms hard and standeth still, then 'tis *deft*, but if it harden upon the *Copel*, before it be moved, then 'tis not *deft*, but all such *Gold* receives a *pale colour* of the *Lead*.

And although many other *Ingredients* do make the *Gold Deft*, which are often used of many, yet I will not set them down (for brevity sake) but leave it to every ones freedom, to follow mine or their own *Instructions*, only I desire they would dilligently observe my meaning, not only in this, but in all my *Books*, and not neglect the *Work* it self, then I hope they will find it right, as they desire, and the *Work* will judge it self. For such a thing cannot well be so pictured on paper, as thereby to judge and comprehend all out of the writing, but by reading *Instruction* comes, and by *Practice* the *Experience*.

2.

3.  
*Alterations*

CHAP.

CHAP.  
XLIX.

## CHAP. XLIX.

*How to cast Gold through Antimony.*Section.  
I.  
*Through  
fine Gold.*

It is an old Invention to cast *Gold* through *Antimony*, so that the *Gold* by it may be made very clean and fine, and therefore, they have supposed, this to be the only means, and none else besides, by which such may be done. Now this is true (when the *Antimony* is good) that the *Gold* may be brought out very high, and almost fine out of the same, so that it will become the finest *Gold* that is, and no *Cement* can be made like it. But because *Antimony* is not all alike good, but some much better than the other, therefore the *Gold* becomes some finer than the other: so it is not well to trust to this, that the *Gold* should alwaies come out sure and very clean. And although the casting through *Antimony* be used sometimes upon many Marks of *Gold*, yet 'tis not taught so, that all such with it may be brought out very fine, and upon the highest Content, but it may satisfy, if it be brought in the quantity, upon the Content of good *Duccats*, for by the higher driving, the *Antimony* comes into the *Gold*, and without a singular Care in purifying of it, it goeth much more off, than by *Cementing*; therefore the best casting through is upon a little *Gold* (to bring such almost very fine and to the highest) which is done thus. If the content of the *Gold* be of 16, 17, 18 or 20 *Carats*, and you would make it very pure and fine, then take one part of the *Gold* (if it be of a pretty rich Content) and two parts of good clean *Antimony* (because the clean  
*Gold*

Gold is sooner to be cast through) put it together in a CHAP.  
XLIX. a Crucible, blow it, let it flow, and when well flown together, then pour it into a warm Cup, made of Iron or Brass, and greased with Tallow or Wax, let the Antimony and the Gold be cool in it, then you must turn the Cup, and dash it upon a stone, whereby the Antimony may go together with the Regulus (which hath settled below and looks of a gray-yellow colour) and be easily beaten out.) But that you may bring the Gold upon the highest Content, cast such Regulus once or twice more with fresh Antimony, and at all times into the Cup, after set the Regulus upon a flat Test in the fire, blow to it, and it will melt quickly, but blow with the Bellows very gently, so that it may just blow upon the Gold in the Test, and do this until the Antimony be evaporated, again very clean from the Gold, and that the Gold do endure the blowing well, and becomes dest, then let it be cool, and quench it in Urine, cast it then to thy pleasure, so you have very fine and high Gold, which is judged fine Gold.

But if the Gold be poor upon the Content, or very light, then take more of the Antimony, and add to a Mark of Antimony 4 Loths of Sulphur, and cast the Gold through with it, as hath been said, and put in the Regulus with fresh Antimony, the second and third time without the Sulphur: Lastly, drive it upon the Test, that the Gold may become very clean: you may also take to such casting through, upon every Mark of Gold, 4 Loths of Copper or scales of Copper, so it will receive a fine colour from it, but when you take Copper to it then take the more Antimony that it may consume it and the Addition.

Some use to the casting of light Gold, which containeth of it, from 12 to 18 carats, a singular Powder of one part Sulphur the other Antimony, and one part of prepared

Section.

2.

To cast  
through  
poor Gold.

3.

Another  
upon light  
Gold.

CHAP. *Caput Mort.* and take to it of *Mark Gold*, 12 *Loths*:  
 XLIX. let it flow well together, then cast it into the *Cup*, and  
 beat the *Regulus* from the *slacks*, and cast it with half  
 so much *Antimony* again twice or thrice, then drive it  
 upon a *Test*, so you have good high *Gold*.

Now, how the *Cup*, *Ingot* and other *Instruments* to  
 the casting through are to be formed, the follow-  
 ing *Sculpture* will shew.

Sculpture XXVIII.



Deciphered.

1. *The Form of the Common Cup, cast in Brass.*
2. *A Cup made of Smiths work.*
3. *A Crucible for the Work.*
4. *A flat Test for it.*
5. *The Ingot.*
6. *The Plates:*

7. Of Antimony with a Gold Regulus.

CHAP.

8. Of Antimony when the Gold Regulus is beaten from it.

L.

Section.

When the *Gold* which is come out of the casting through, is blown clean, yet it may retain a smack of the *Antimony*: to prevent this: Beat the *Gold* very thin, lay it in a particular *Cement* made on purpose, as is mentioned in the Description of the *Cements*: Let it stand some hours in it, so it will extract such also, and becomes clean.

To lay the Gold which is cast through the Cement.

CHAP. L.

How the Black or light Gold, containing much Silver, is to be separated.



THE *Silvery rich Gold*, especially that which comes of from melting, of which a *Mark* contains from 9, to above 12 *Carats* off fine *Gold*, this is to be separated thus: Grain it in a boyling *Water* (as above is said of the fine, thin and even *Silver*) then prove it, so as it hath a like *Content*, then take the *Grain'd* and moisten it with water, and take to every *Mark* (of the above-mentioned *Pouduers*) 12 *lots*, of good *yellow Sulphur*, and mingle it with them; and put it in to a *glazed Pot*, luted with a cover, and make a fire round about it, till the *Pouder* on the *grain'd* be well flown; let it cool, then beat the *Pot* in pieces; then take and put the *grain'd* into a *Crucible*, set it in a *Wind-Oven*, let it flow very well, and cast upon it a little ground *Sandover*, mingled with *grain'd Lead*, let it stand a little longer, then pour it into a warm luted *Iron Morter*,

CHAP. *ter*, and if much of it settleth to a *Regulus* on the bottom, and the Silver becomes a *scorias*, then beat it off from the Gold *Regulus*, which will be *yellow* and *gray*, but because the *Silver* of the first *Fluss*, will not all come into the *scorias*, therefore grain the *Gold* once more, and prepare it with the *Powder*, and let it flow, and pour it again into the *Morter*; Lastly, take the *Gold*, and cast it through only with the *Antimony*, blow that which is cast through upon a *Test*, and cast it clean, so you will have good and *Deft Gold*; This *casting* through, is a way if one have need of the *Gold* in hast, else there are other and better ways, namely, when the *Gold* is cast once or twice with *Sulphur*, that it may be driven *deft*, and then cast into an *Ingot*, then *beaten* thin and *cemented*, whereby not so much will go off from the *Gold*; but it requires greater time.

Section.

<sup>2.</sup>  
To cast the  
used *Anti-*  
*mony*.

<sup>3.</sup>  
The *Iron*  
takes the  
virtue of  
the *Anti-*  
*mony*.

<sup>4.</sup>  
To beat  
down  
(through  
casting) the  
*Scorias*.

The used *Antimony*, through which you have cast at last the *Gold*, retain singly, and put it again in a *Crucible*, and let it flow well, and add to it filed *Iron*, so much, that the stirring-hook with which you stir it about, may no more be touched, so the *Antimony*, eats it self weak on the *Iron*, (which it doth easily touch) and doth let the *Silver* and *Gold* fall, as much as it hath with it, then pour it into a *Morter*, and according to the quantity, the *Regulus* will settle it self on the bottom, this retain singly or apart.

The *scorias* which is come from the first casting (as above is mentioned) put likewise into a *Crucible*, and beat down the *Silver* in it with *grain'd Lead* and *filed Iron*, as long until the *scorias*, with the *Iron Hook* (that stirreth it about) toucheth no more, by this time, almost all the *Silver* will fall down, and of this *Silver*, retain also a part.

The remaining *scorias* with the *Antimony*, which is left out of the *Silver* and *Gold*, (as now signified) being



ing precipitated; take them together and put the *Lead* CHAP. LI.  
 upon a *Flat Test*, or in an *unglazed Clay Dish*, set two  
 of them within one another, and when it is entred, then  
 let it go off upon a *Test* (as is usual) and observe when  
 the entred *Lead* begins to drive upon the *Test* and goes  
 clean, then put the *Silver Regulus* (which is fallen out of  
 the *scorias*) upon a *Test*, that it also may go off clean,  
 and then this *Silver Proof* upon *Gold*, will shew how  
 rich it is in *Gold*; also prove the *Regulus*, which is fallen  
 out of the *Antimony* upon *Gold*. If now the same *Re-*  
*gulus*, (which before by it self is to be burnt upon a *Test*)  
 be not very rich in *Gold*, then put it also among the *Sil-*  
*ver*; and separate it apart in *Aqua fort.* and you will hard-  
 ly find a nearer way to make such *Gold* clean: and al-  
 though this Instruction looketh as if there were an *Ambi-*  
*guous* way, yet it is not; but when one is in work, then  
 it goeth soon to an end; for the *Gold*, thus with the *Sul-*  
*phur* and *Antimony* prepared, floweth easily, and thereby  
 many castings may be done in a day, or in half a day,  
 yet every one may require a consideration, how the best  
 is to be done.

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## CHAP. LI.

*How to separate the used Antimony.*

**I**N regard that the burnt *Antimony* keep-  
 eth back somewhat of *Gold*, yet there re-  
 mains *Gold* and *Silver* in it, now to  
 bring this clean out of it (which is called  
 to refine the *Antimony*) do it thus:  
 Put the used *Antimony* together, in a  
 Crucible; and if it be a pound, then add 4 *Loths* of filed  
 M m m Iron,

Section:  
 1.  
 To Refine  
 Antimony.

CHAP. Iron, 1 *Loth* of Copper, 4 *Loths* of Lead, and 4 *Loths* of  
 LI. *Littarge* to it, let it flow well together, then cast it  
 into a Cup, or let it cool in the *Crucible*, then  
 set the *Antimony* again in the *Crucible*, and beat it down  
 with a little *grain'd Lead* and *Littarge*, and cast upon it  
 melted Salt; let it stand well in the Glass, and cast it into  
 the Cup, then drive off the *Regulus* which cometh out of  
 it, upon a *Test*, then you will receive the *Gold* and *Sil-*  
*ver*, as much as the *Antimony* had retained; this you  
 may cast once more through with fresh *Antimony*, and  
 so the *Gold* will come out, yet the *Antimony* will re-  
 tain still some of the *Gold*, (which comes in the *Silver*,  
 made out of the *Antimony*) and this is to be separated  
 in the *Aqua fort.* and if it be too rich in *Gold*, then must  
 be added to it, *fine Silver*, that the *Water* may touch  
 it.

2.  
 To precipi-  
 tate it.

Section.  
 3. But some do use the parting of the *Antimony* thus,  
 they take a part of *Antimony* and one part of *Vitriol*,  
 one part of *grain'd Lead*, one part of *Salt Petre*, three  
 quarters of *filed Iron*, and a little *Copper*, and this they  
 put into a *Test*, and let it evaporate, so there will remain a-  
 mong them another *mixt matter*, to this they add (ac-  
 cording to the quantity of the *Antimony*) more fresh  
*Lead*, and boyl it clean up, then drive the *Lead* off upon  
 the *Test*, and so will it find in it self the *Silver* and *Gold*,  
 which the *Antimony* hath had by it self.

4.  
 Rich Antis-  
 mony. When the *Antimony* is very *Rich* in *Gold* and *Sil-*  
*ver*, then may it be made pure, as followeth (and it is the  
 best cleansing, only that it taketh much labour and some-  
 what longer time) Take the *Antimony*, put it upon a  
*Test*, let it flow well, and add to it *filed Iron*, and stir it  
 about always with an *Iron*, and cast as much of the  
*filed Iron* into it, until the *Iron*, with which you stir it,  
 touch no more the *Antimony* (as before mentioned) which  
 is then very easy to be seen; then add to the same *Anti-*  
*mony*,

mony, *Lead*, and boyl it clean up, by this addition of the *Iron*, the wildness is taken away from the *Antimony*, so that then (which is very easily boyled up) it will go clean off upon the *Test*, and will not work upon the *Test*, which is a good way.

CHAP.  
LII.

CHAP. LII.

*How Gold may be made fine and clean through Aqua Regis.*

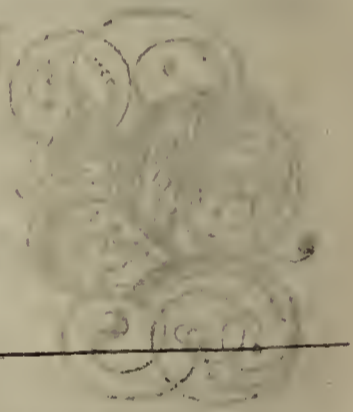
**B**ECAUSE the *Aqua Regis* toucheth only the *Gold* and not the *Silver*, therefore I judge the *Gold* may be made purest and finest by this way. Take good *high Gold*, set it upon a good *Test*, made on purpose for it) let it go off upon it, with clean *Lead*, that you may be sure no *Copper* remains in it, then blow the *Gold* upon the *Test*, unless it become deff, then beat it thin, glow it, and then put it in a good and well luted *Glass Bottle*, pour upon it *Aqua Regis*, and dissolve all the *Gold*, and what will not dissolve but remain in the bottom of the *Glass*, that is no *Gold*; then pour the *Aqua Regis* (in which the dissolved *Gold* is,) clean off, and put it in another *glass Bottle*, and draw the water from it, then the *Gold* will remain in the *glass Bottle*; cast it together and blow it clean, and this *Gold* thus prepared may be judged, as *fine Gold*, because the *Aqua Regis* toucheth nothing but *Gold* and *Copper*, and if the *Gold* be first made clean from the *Copper*, upon the *Test*, then can nothing else but  
pure

CHAP. pure Gold come out of the *Aqua Regis*, but how much  
 LII. good *Aqua Regis* (as I have said) is to be made, of this,  
 you have been sufficiently instructed before.

*Thus much Courteous READER, I was willing to describe of the Gold Oars and their Labour, as a furtherance to Experience, and for the use of common Mine-Workers, and yong Assayers, and so leave it to further Consideration.*

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The END of the second Book.



OF  
Copper OARS.

## B O O K III.

## CHAP. I.

*How to know Copper Oars.*

HIS *Third Book* describeth *Copper Oars*, and how they are to be known, and then how to assay them, as also of the *Black Copper*; and lastly, how the pure *Copper* is to be tryed, and also how after the *High Dutch* and *Hungarian* manner the *Silver* is to be refined out of *Copper*, with *Instructions* annexed of a singular new way to refine *Copper*, and how *Brass* is to be made out of *Copper*, and how *white Iron* may be made *Copper*.

Now, *Copper Oars* are more easily to be known than any other *metallick Oars*, as having in them varieties of *Colours*, so that many more delicate colours come out of them then from any other *metallick Oars*. And of these there are three sorts.

First, *Copper Glass*, and this is to be numbred among the *deft*, and *smooth flowery Copper Oars*, for the *Copper-Glass Oars* which are *blewish*, (and yet their colour come near to *Grey*) are the richest *Copper Oars*, and contain the most *Copper* and *Silver*, and yield *deft* and good *Copper*.

Section.  
1.  
The Purpose  
of this Book

2.  
Copper Oars  
yield fine  
Colours.

3.  
Copper  
Glass.

CHAP. Secondly, the *green Coppers* which are rich in *Copper* but poor in *Silver*, also the fair *lazure colored Copper* or *blew* and *Green-mixt-copper-Oars* contain likewise much and good *Copper*, but generally very little *Silver*.

Section.  
4.  
*Green and  
lazure  
Colours.*

5.  
*Brown Cop-  
per.*

called  
*Gambes.*

Thirdly, the *brown copper Oars* (like an *iron Vein*) if they be either harsh or mild, yet they are found rich in *Copper* but poor in *Silver*: likewise also the *copper shiffers* (in which there are Characters or *Figures* of *Fishes*, *Snails*, and other Resemblances and representations of corporeal Creatures) and also rich in *copper*, and commonly do contain *Silver*.

6.

In brief, all *copper Oars* and *shiffers* that have no flinty, speizy or other harsh matter within them, are to be reckoned among the *soft flowing Oars*.

7.  
*Copper  
flint.*

But there appertains to the *harsh flowing copper Oars*, the *harsh copper Flint*, and what is *splendy*, *mispickly*, *glimery* or *spady*, as also all *flint Oars* by themselves without any other *Oars* mingled with them, or *shiffers* in which the *copper flint* doth stand streamingly intermixed.

8.  
*Copper  
stone.*

Also the *raw slack stone*, *copper-stone* ( *Oven-breachers* occasioned from melting such raw *Oars*.)

Now, as the *silver Oars* are known before the proving and melting, (as to their natures) and how they may do in the *fire*, so it must be known likewise with the *copper Oars*, that one may help them in proving and melting: And because they differ, therefore the *raw, unflowing copper oars* do not prove like the *weak flowing and milde*, as will follow in my Instructions, but it must first be shewn how the *Assay Crucibles* also the *little Ovens* for proving *copper Oars* are to be made, (and in case of necessity) that an *Assayer* himself may prepare his stuff and *Instruments*.

CHAP.

## CHAP. II.

How to make Crucibles and Ovens to prove Copper.



O the *copper Oars* which are to be proved for *Copper*, one must have little and good *Crucibles* for them, which the *Goldsmiths* do use: But, because they are not to be had in every place good, and in a fit *Mould*, therefore I Judge it convenient, That every *Assayer* do make such himself.

Section.  
1.

To the making such *Crucibles*, *Frames* or *Moulds* of *Brass* are necessary (or of *Pear-tree* wood, so that one may put on it an *Iron ring*, that the *Mould* may not be so apt so break.)

2.  
*Crucible form.*

The stuff or clay out of which you intend to make such *Crucibles*, prepare them of *Potters Clay*, like the *Tests* for making *Proofs* of *Silver Oars* (as is before signified) then take a *Ball* of such *Clay* (as much as you think fit) and press it into the frame or mould, so that the *Clay* on the sides may well go up and in the middle remain a pretty deep hole: after the manner that the *Crucible* is to be: then anoint the upper part over with *Bacon*, or *Oyl*; and put it into the *Frame*, in which the *Clay* is to be pressed until it toucheth the top of the *Frame*, then turn the upper part of the *Frame* downwards, and that which is put in will easily be drawn out again; and thus the *Crucible* is formed in the frame, as it ought to be, set also the frame (while the *Crucible* stands yet in it) a little while before the *Sun* to be warmed, then the *Crucible* will go out very well and sound, and, although it might be pressed out otherwise, yet it can-

3.  
*The Clay's*

can-

CHAP. cannot be done so conveniently as when it hath stood  
 II. a little near the warmth, because thereby the *Clay* doth shrink, so that the *Crucible* by that heat may well fall out of it self.

But why the lower part of the *Frame* must not be fastned, the reason is, that the *Crucible* may be lifted out of the upper part of the frame, and it could not be brought off again without spoil, therefore it is better the lower part remain ungreased, that the *Crucible* may be brought out whole. But when the stuff is made very brittle, and the *clay* not fast, then annoint the lower part with fat, and the *Crucible* will easily be brought out with your fingers, and so remain whole.

Thus they make *Assay-Crucibles*, and when they are well dryed, let them burn in a *Potters-Oven*, or a *Tile-Oven*, yet let them not be set in too strong a heat (lest they melt) and they must be taken out in time.

Section.  
 4.  
 Little  
 Ovens for  
 Copper.  
 Proof.

But what concern the *little Ovens*, (wherein they use to take the *Copper* proofs) the best are prepared of *Potters* stuff or *Clay*, to be set and used at pleasure: and make them thus, Take the prepared *Potters-stuff*, and form of it a little round-*Oven*, the *diameter* nine inches wide, with which the *Proof-Oven* useth to be divided, (of which *Instruction* is given in the first *Book*) and 12 inches high, and in the midst a *Belly* of 11 Inches, and no bottom below, yet it must be an Inch and half thick, and as much as the clay shrinketh, so much must be added again, and whilst 'tis yet soft, it must be cut in the edges, that one may put *Iron-hoops* about it, and with *Cross-Bars* joyn the upper and lower *Hoops*, or else it will very easily fall asunder: Now, when this *Oven* is very well dryed in the Sun (or warm place) then let it be burnt hard in a *Potters* or *Tile-Oven*, and lute it well about with the *Iron-hoops* and *bonds* (as has been already taught)

After



After this make a foot with a bottom, to this *Oven* of *Potters stuff*, being three square fingers deep within, and just so broad as the little *Oven* below, having a hole in the side, as wide as the breadth of a large Finger, through which the *Bellows* is to blow (as you will hear hereafter) and there may be an edge within the top upon which you may lay a little *Iron-Grate*, as in the *Sculpture*: this foot must also be burnt in a *Potters-oven*, and bound about with *iron-hoops* and *bonds*, as the *oven*: then lay the *Iron-Grate* in it, and set the *Oven* upon it, then 'tis prepared as it ought to be.

CHAP.  
II.

Now, when you will prove in it, set it upon the *Grate*, in the little *Oven*, on a little foot made of *Potters Clay*, which must be three square fingers high, but not full three fingers broad above, upon which the *Crucible* is to stand with the *Proof*.

Also there must be little *Covers* to the *Copper-Proofs*, which must be put to, or luted upon the *Assay Crucibles*: and they must also be made of *Potters-stuff*, and burnt as the other, but not by a sudden heat lest they crack: and be careful to cover the *Crucibles*, that no *Coals* or uncleanness fall therein, whereby the proof may become false.

There may also a *little oven* be made, just in the form and wideness as before, only that it have a *Bottom* and be 14 *Inches* high from the bottom, and that two inches from the bottom there be two holes quite through it, in which you must fix two *Iron Bars* a finger thick, and lay upon it a little *iron Grate* (like that before) and under the *Grate* let there be made a hole of a finger wide for the *Bellows*, This little *oven* which also must be *Hoopt* about with *Iron*, and is in all things like the other only this is whole, but the other may be taken asunder in two pieces.

Section.  
5.  
Another  
Form of a  
little Oven:

In case you want *Bellows* to such *ovens*, there is ano-

O o o

6.  
A little  
Oven of  
Tiles.  
ther

CHAP. II. ther *Oven* to be made, in which the proofs may be proved: thus, Take burnt *Tiles*, joyn them together in a square, about a span wide, with good *Clay*, and lute the joynings with it, and leave a *Wind-hole* before, as wide as the *Oven* is, a *Tile* and half high, and over the *Wind-hole* in the *Oven*, lay a little *Grate* of *Iron*, and four square *Bars*, a finger thick, and a span high from the *Grate*, so is your little *Oven* prepared, but before you prove in it, you must glow it with fire; that it vapour not in proving, then set upon the little *Grate* a little foot, for the *Crucible* to stand on, and when the *Crucible* with the proof is set in, and coals and fire put upon it, and that it grows warm, then fan in some air with a wing, by the *Wind-hole* in the little *Oven*, so the wind will ascend through the *Grate* into the fire strongly, and the *Copper-Proof* will boyl it self up in the *Crucible*: This is an easy way for preparing this little *oven*, but you must observe to do things exactly, that the *Proof* may be compleat in the fire.

Section.  
7.  
Proof of  
Furnaces.

There are also used to the *Copper Proving Furnaces* (such as *Gold-smiths* have) to boil up the *Proofs* before the *Bellows*: but I judge because the blowing in the *Furnace* goes but on one side of the *Crucible*, therefore the *Proofs* cannot be so well boyl'd up on all sides, as with *Bellows* which go from below upwards. Also when the *Bellows* blow but on one side, the *Crucible* is apt to break, especially when 'tis not good: therefore how the above-mentioned *Ovens* are to be formed within and without, is shewed in the *Sculpture* following.

Sculpture.



Deciphered.

1. *The inside of the little Oven made of Tiles.*
2. *The same, when it's closed.*
3. *The foot of the Crucible upon the Grate.*
4. *The little Oven of Potters-Clay, bound with Hoops.*
5. *The foot of it.*
6. *The iron Grate in it.*
7. *The Crucible upon the Grate with the proof in it.*
8. *The Wind-hole through which the Bellows are put.*
9. *The Whole little Oven open with the Bottom.*
10. *The Iron-hoops which go about it.*
- 11 } *The Bellows, Brush and Instruments.*
- 12 }
- 13 }

CHAP.

CHAP.  
III.

## CHAP. III.

*How to make a Flus to prove Copper Oars.*



¶

TAKE two parts of *Argol*, and one part of *Sulphur*, grind them small and mingle them, put it in an unglazed Pot, then put live Coals in it, when it begins to burn in the Pot, let it burn till it gives over of it self, let the Pot be cool, so the *Flus* is prepared; then take it out of the Pot, put the Coals away, and keep the *Flus* small ground in a warm place, so it will remain good; for, if it be set in a cool and moist place, it will turn to *oyl*: or, take the pot, let it be warm, pour the *Flus* into it, and cover it; thus the *Flus* will kindle it self in the pot, and burn out: this *Flus* is to be used to good and *deft* Copper Oars: But what be *flinty*, and other Oars which are *hard* to separate, to such this *Flus* is too weak, and there must be something added to it, as you will hear in the *sequel*.

## CHAP. IV.

*How soft flowing Copper Oars are to be proved.*



TAKE *smooth-flowing* and good copper oars (which are not *flinty* and *speizy*) prove them thus, Grind the *Oar* small, and weigh of it with thy proof-weights two Centners, and put them in a Crucible, and three times so much of the before

before mentioned *Flus*s, both well mingled, and cover the *Crucible* above the *Oar* and *Flus*s with common *Salt* a full finger thick, press it down and cover the *Crucible* luted with *Clay*, that it go not off, nor *Coals* fall therein, and make a fire in one of the said little *Ovens*, set the *Crucible* upon the little foot, cover it with *Coals* higher than a hand breadth, let it be warm, and blow through the hole under the *Grate*, that the wind may go alike round about the *Crucible*, and let it stand a while in the *fusion*, so the proof will boyl clean up, and if the *Crucible* doth not break, then take the upper fire off and lift the *Crucible* hot, out of the *Oven*: set it upon a plain *Tile*, that if the *Grains* of *Copper* be not run altogether, it may be helpt: Then let the *Crucible* cool, open it, and in the bottom you will find a *grain* of *Copper* which is fine. For these good smooth *Oars* will yield fine *Copper*: Then draw it up with thy proof-weights, and try how many pounds of *Copper* a *Centner* of *Oars* doth yield. But you must observe in the proving, that you drive not the proof too hard in the *Crucible*, for the *Copper* will burn, and drive it self very easy in the *slacks*, as one may see in the *slacks*; (which will soon receive the colour of the *Copper Oars*) for when they are very red in the *Crucible*: then the *Copper - Proof* is driven too hard, and the *Content* is lighter, but if the *slacks* are *brown*, then the *Proof* is made.

CHAP.  
IV.

Ppp

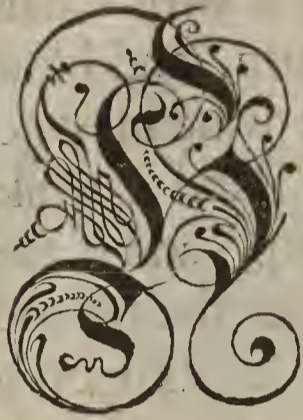
CHAP.

CHAP.  
V.

## CHAP. V.

*How hard flowing Copper Oars are to be proved.*

Section.

1.  
The manner  
of it.

**H**ARD flowing *Oars* are not to be proved as the smooth, but in another manner: thus, Take the *Copper Oars*, beat them as small as the Seeds of *Hemp*, and mingle them together: weigh two Centners of it in the proof-weight, put it in a proof-Test, set it in a proof-Oven, give it a very gentle fire, that it may begin to roast it self, then stir it with an iron about the Test, else the *Oar* will turn to *Ashes* together in the Test, and will not rost: and when 'tis stir'd the first time, then give it a little stronger fire, that it may glow well, lift it out of the *Oven*, and let it cool, then put it in the *Oven* again, and let it roast again untill it hath done smoaking (and smells not of *Sulphur*) then grind it a little smaller, yet not so small as Mill-dust, and roast it again till it stinks no more *Sulphurish*, then stir it once or twice with the little hook, that it may not be ashes again.

2.  
The *Oar*  
burnt quite  
dead.

When 'tis thus ground anew, and wash'd the second time, let it cool, and set it the third time in the *Assay-Oven*, then roast it, and grinde it very small, then wash it once more that it may be burnt quite *dead*, then grinde it again very small, so is it prepared for the Proof. Then divide the *Oar* upon a Ballance in two equal parts, and put one part in an *Assay-Crucible* with 3 times so much of the foresaid *Fluss*, and with a fixt part of *flowing Glass-Gall*, mingle them well in the *Crucible*, and cover it with common or *flowing Salt* (as in the proof before) and

and lute it over on the top with *Clay*, that the Cover be fast, so that no Coals may fall in, then set it in a little Oven, blow the *Bellows*, give the proof a strong sudden fire (a little stronger then the former proof) and when the proof hath stood in a pretty good *Fluss*, then lift the *Crucible* out of the fire, and let it cool, and break it, and so you may find in the bottom a *Grain* of *black Copper*, of such Goodness as the *Oar* and *Flint* is in the melting, and may thereby get *Copper*, which is the right proof of it.

Yet there is of one sort of *flinty Oar*, fairer *Copper* than of another, and commonly all *flints* which are of an *iron Nature*) yields *iron streamy Copper*, therefore they are not to be used for making of *Brass*.

Section.

3.  
Some Cop-  
per not fit  
for Brass.

Of this *graind Copper* (as it comes out of the Proof) weigh it with a *Centner weight*, then you may see how many pound of *black Copper*, a *Centner* of *flint* or *raw Coper Oar* do yield, so you may easily reckon how many such *Centners*, do afford one *Centner* of *Copper*: and know therefore, that if you do weigh two *Centners* of *flinty Oars* to the proof, if the proof should be amiss, then you have a *Centner* more of the roasted *Oar* or *flint*, to make another proof, otherwise it will be a great hindrance to roast but one *Centner* to the Proof.

But on the contrary, the old *Assayers* have used this Method, and proved every *Copper Oar* or *flint* upon pure *Copper*, and thereby know how many *Centners* of it, will yield one *Centner* of pure *Copper*: this I believe to be a just proof for them, who have roasted and purified the *Copper* themselves. But those who work the *Silver* in it, and sell it with the *Silver*, it is better for them to know how many *Centners* of *black Copper* they may have in a *roast*, so they may know how many *Loths* of *Silver*, a *Centner* of *black Copper* contains.

And among all meltings, the Operation of *Copper*  
upon

CHAP. (upon which is to be made a proper Account) is the  
 V. most pleasant and fairest Experiment; for if the Proof be  
 right, then what is produced will be so too.

Section.

4.  
 To boil  
 Oars for  
 Copper.

Therefore, if you will (with the old *Affayers*) prove the Copper-Oars upon boiled Copper, do it thus, Grind the *Oars* small, weigh of it two Centners: if they be unflowing or flinty then roast them (as above) in an *Affay-Crucible*, and weigh to it four Centner of *Fluss* or *Lead-glass*, made of *Littarge* and *Flint-stones* (as in the first Book of *Silver Oars*) and mingle them well, and cover it with *Salt*, and also cover the *Crucible*, and set it in a little *Oven* before the Bellows: and let it flow like another *Copper-Proof*, and when 'tis cool open the crucible, and in the Bottom is the *Regulus*, among which is copper, and lead together, put it upon a flat *Test* luted with *Littarge*, drive it till the copper appears to be of a clear Green, then lift the *Graind-copper* from the *Test*, and quench it in *Water*, and weigh it with thy *Proof Weight*, so you may finde how many pound of boyled copper you have from two centners of flinty-copper *Oar* in the Proof: one may also very easily burn the copper, especially if the *Oar* be poor in copper (as you may finde by the Operation). Therefore I conceive it better, to prove the copper *Oars* first upon *black copper*, and then upon boild copper: and this way, the Proof of the light contenty copper *Oars* cannot so easily be hurt.

CHAP.



## CHAP. VI.

*How to prove light Coppers.*Section.  
I.

SOOR *copper-Oars* (especially the copper Flints and copper-Glafs which are in the Mountains or in light *shiffer* Mines) they must be proved thus; Take a common Proof of the *Oar*, grind it well, and weigh with thy Proof weight twenty or more centners, and draw it in a Vessel, so that therewith the light *clay* may be separated from the pure *slick* and *copper Oars*; weigh the *slick* which comes from it, thus, and mark how many centners yields a pound, that you may know how many *centners* of raw *Oar* (from the Rock or vein in the Mine) do yield a clean *centner*.

Weigh then two *centners* of such pure *slick*, and put them in an *Assay-test*, to be roasted in an *Oven* (as you have done with the copper *Oars*) but that the proof may not be false, (because the *slick* doth use to sparkle in the first setting of it into the great heat, especially if *pibbles* be among it,) therefore cover the *Test* wherein the weighed *slick* is, with another *Test*; let it remain thus covered till the *slick* glow well; then take off the upper *Test*, and roast the *slick* (as you are instructed before) and then grinde it very small, and divide it into two equal parts, and mingle one of them with the *Flus* (appertaining to the copper *Oars*) and put it into a *crucible*, covered with Salt, and do as you have done above with the harsh *copper Oars*, and you will find in the bottom of the *crucible*, a grain of *copper*: then weigh this with your Proof-weight, so you may know out of how

Q q q

many

CHAP. many *centners* or quantities of such *raw*, *rocky* or *wash-*  
 VI. *work* you may make of a *centner* of black *copper*, which  
 grain'd *copper* you may prove afterwards for *Silver*,  
 and find the Content, and maist order thy matters ac-  
 cordingly.

Section. This proof upon poor mixt *copper-Oars*, I have put  
 3. here because experience manifesteth, That the *Copper*  
*Oars* do not break throughout clean upon the *Veins*, but  
 have much *flint* and subtil *copper-glass* mingled with  
 them, yet in the washing they do willingly separate from  
 it, and bring it into such a compass that one may know  
 that all the rest of the *Oars* from those *Veins* may be  
 wrought to good profit, which could not be, if they  
 should be melted raw.

4. Concerning the poor *Shiffer* which contains very  
 little *Copper*, they cannot well be brought into compass,  
 for they rise for the most part in the *Water*, and are *fu-*  
*gitives*, although some do separate in the water, and af-  
 ford a *slick*, and thus they may be brought into com-  
*pass*, and may be thus proved, and made to profit like  
 the other *Oars*.

5. Then the *Copper-flint* will stand apparently mixt and  
 streamy, in some *shiffers* which are to be proved either  
 raw or among others, or the *shiffer* apart whereby  
 it may be found what *copper* the *Shiffer* doth yield,  
 and the melting ordered accordingly.

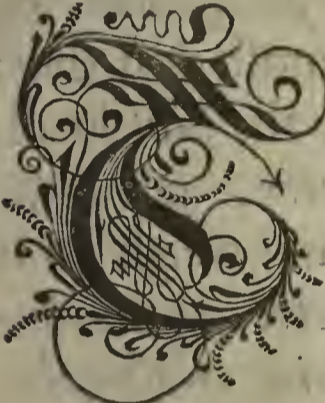
6. The other mixt *copper-Oars* (as *Lasure Copper green*,  
 or *brown rich copper-Oars*) cannot be well separated in  
 the water from their mixtures, for they are very light,  
 and run not in weight, like the other flints, but go  
 forth in the water, therefore such are first to be proved  
 for *Silver*, if they have none (as commonly they are  
 poor) then tis not much to try, but if they contain *Sil-*  
*ver*, glow them hard, and suddenly quench them in  
 cold water, then the *insperged* or mixt *Copper Oars* will  
 run

run together in little *Grains* (as above is signified of the *Gold Oars*) then wash and grind them small, and draw it into a *slick*, and when it separates, then you may in the great *Work* according to the quantity of *slicks* regulate your self. But how these copper *Oars* are to be dried in the little *oven*, you will be directed hereafter.

CHAP.  
VII.

CHAP. VII.

*How light Copper Oars which are mixt and insperged with flint, may be brought to profit.*

 **T**HE light flinty insperged copper *Oars* (by reason of their hardness and unflowingness) cannot well (in a great quantity) be melted throughly, or brought to profit (the flint being so hard, and before it becoms small enough in the *Beating*) it makes insperged *oars*, subtil, and rise in the water: therefore there can no surer or better *Method* be found for such *Oars*, than to roast them in an high roast *oven*, made on purpose, (as before is often mentioned.) And when it burns to a great heat, pour water upon it, and let it cool suddenly, so the *frighted Metal* will run together in *grains* in the *flints*, which are heavy, and remain fast by setting them in the water, and then they may be washed and separated, and that which is not clean *Copper* will be a good and heavy *Copper-stone*, that so the flinty copper *Oars* (when they are roasted and are brittle) may very easily (in a great quantity) be buck'd through, and the *Metal* which is gathered may be washed, or so much of it, as in one gathering can be melted throughly (like raw *Oar*) which is to be made into ten or more equal

CHAP. VIII. equal parts. And the roast oven which is to be used to this Washing, may be formed (as in the first and second Book of *flinty Gold Oars*) are more fully described.

## CHAP. VIII.

*How to prove Copper Oar from Copper-stone.*



IF one would try and prove *Copper oars* especially the *flinty* (containing much or little *Copper*, called *raw slack-stones*, or *raw Copper-stones*) you must do it thus; Grind the *Copper oars* or the *flint* small, weigh from it two *Centners*, put them thus, unroasted in an *Assay-crucible*, and weigh to it four *Centners* of the *flus* made of *Salt petre*, and *Argol* (as before) with two *centners* of *flowing Glass-galls*, mingle all in the *crucible* and cover it (like a *copper-Oar*) with *Salt*, and set it in a little *Oven*, and boil it up also before the *Bellows*, and let it be cold, then you will find in the bottom of the *crucible* a *copper-stone*, then separate it from the *slacks*, and weigh it, so you may see how many *centners* of the *flint* yields a *centner* of *copper-stone*. But if the *flint* be very rich in *copper-water*, then there will be no stone with the *flus*; therefore try the *flint* in another manner, *viz.* Weigh it raw, and put it in a *crucible*, mingle among it three times so much of clean good *slacks* (smooth ground) which yield no stone, nor contains any *Silver*, but come from poor *Oar*, cover it with *Salt*, and set it in, let it flow with strong blowing: then you will find as much as the *flint* hath in it self: But the *flints* that are rich in *copper-water* do yield a *slack-stone* which is not good to be melted, for  
in

in the roasting, it will shrink too much and retain no CHAP.  
Silver in it self, by which many times hurt is caused. IX.

## CHAP. IX.

*How to prove Copper Oar another way.*



Section.  
1.  
**S**LL *Copper-Oars* that are rich or poor in copper may be tryed upon *copper-stone*, after this manner, Take a pound of the Oar or Flint small ground, and prepare a little *Oven* of *Tiles* square or round of a span wide, or let it be joyn'd with *Potters-clay*, bind it about with *iron-rings*, and lay below in it, Powder of Coals and Clay, (as in the Melt-ovens) with a hole on the back of the *Oven*, through which the *Bellows* may go; then put in your fire and Coals, and blow them well, that it may glow, and set the *raw Oar* which is ground, in it; yet not at once, blow continually strong at it, that the *oar* may melt through the Coals down into the little *Oven*, and when it is enough, let it cool, and take it out of the *Oven*, and beat it, so you will see what it yields of *copper* or *copper stone*: if you finde in the *stones* either *copper* or *slacks* like *grains*, beat them small, and draw it into *slicks*, then will the *copper* and *stone* separate from the *slicks*.

This is a fine Tryal upon the *copper shiffer* and poor 2.  
*insperfed copper Oars*, but when the Oar doth not Copper Shiffer.  
yield *stone* or *copper*, you will see it in the *slacks*, when they are not *coppery*, but all is turn'd to *slicks*.

Further, if you would have such through-proofs of 3.  
*copper*, and the flint yeild no *stone*, then first roast the When there will be no stone in the proof.  
*flint* quite dead, and melt it in the little *Oven*, and you

R r r

will

CHAP. will finde a *Regulus* of *black copper*, or such as the *flint*  
 X. or *copper Oars* do yield, which put together and weigh,  
 and see what it hath yielded, so you may know how ma-  
 ny *Centners* of *flinty copper* it yieldeth from a *Centner*  
 of *copper*, for all roasted *Oars* work themselves *fresh*, and  
 separate better than raw *Oars*.

☞

4.

Another  
way.

5.

6.

But if one will try more than one or two pound in  
 the little *Oven*, then one may *slick* it off from the *copper*  
 with a little hot *Crucible*, and separate it from the *slacks*,  
 but what remains in the little *Oven* together with the  
*slacks*, which are not flown out, must be beaten and wa-  
 shed, and what is found shall be reckoned the *Content*.

Also in this wise one may melt raw *copper flint* un-  
 roasted in the little *Oven*, and drive it off, and see whe-  
 ther it give good *copper-stone* or raw *slack-stone*; also  
 whether the *stone* in the *fire* be fixt or volatile: Only  
 observe, that the little *Oven* must be first very well glow-  
 ed, before it be melted in it, or else it will become all  
 cold in the little *Oven*, and will not come together, as ex-  
 perience teacheth.

## CHAP. X.

*How to prove melted Copper-stone.*



1.

OPPER STONES are best prov'd like  
 a raw *Copper Oar* or *flint* (as hath been  
 formerly shewn) *viz.* if one beat the  
 same very small like *Hemp-seeds*, and  
 then weigh it, and in a gentle fire upon  
 a *Test*, let it be roasted, and put in the  
 ground pieces, until it burns it self dead, and then let  
 it be ground smaller, and mingle it with *flus*, and a lit-  
 tle *Glass-galls*, and cover it with *Salt* in the *Crucible* lu-  
 ted

ted in a little Oven, it will boyl like a raw Copper Oar CHAP.  
 or *flint* before the Bellows, and will settle it self to a *copper Grain* in the bottom of the Crucible, draw this up X.  
 and weigh how much it contains, and make thy account upon it, how many Centners of *copper-stone* yields one Centner of black and unpurify'd Copper.

There is another Tryal, *namely*, to weigh two Centners of Copper-stone, and mingle them with *Borax* and a little *Venetian Glass*, and let it flow upon a *Proof Test*, and blow with a hand *Bellows* until it appears green, so you will see how much the *Copper-stone* yields of *Copper*: and in this Proof the *Copper* will become clean and pure and most ready, and yield no black *Copper* (as in the Proofs above it doth.) Section.  
2.

That you may see the form of the little *Ovens*, and how to make the *Copper-Proofs* in them, they are in the following *Sculpture*

Deciphered.

1. *The melting Oven to try the Copper Oars from the copper-stone, and the Man that blows the Bellows.*
2. *The luting it with Clay.*
3. *The buck'd and vvasht'd Oar.*
4. *The little Ovens in which the copper-Oars are to be proved with ordinary Bellovvs, and the man that attends them.*
5. *The Bellovvs as they are used.*
6. *A copper Instrument with a neck in which water is put, and then set over the fire, and used in stead of Bellows (call'd the Philosophical Bellovvs. See Sculpture II. Book I.*
7. *The Pot in which the Flus is to be made.*
8. *The Assay Crucible.*

Sculpture



## CHAP. XI.

To prove Flinty Copper by Sulphur.

Section.  
I.



BECAUSE all *Flints* have *Sulphur* in them (yet some more than others,) if you will try them, and make a proof upon them, Weigh two *centners* of the *Flinty raw Oar*, and put it in a *Proof-Test*, and roast it dead (as I have mention'd



tion'd before off the *Copper Oars*) let it be cold and weigh such roasted Oar again, now so much as these two *Centners* have lost, so much they have had of *Sulphur*, for the *Sulphur* goes in the fire and in the air, this proof is easy, yet it is not manifested what *Sulphur* it doth yield, but that you may have the same *Sulphur* apparently; Beat the flint small, to the bigness of an *Hazel nut*, put it in a great *Retort* made of the best *Potters-Clay*, that the *neck* of the *Retort* may hang in water, make a wood-fire about it, then the *Sulphur* will ascend from the *flint*, and you will find most part before in the *Receiver* of the *Retort*, fine and yellow, but 'tis yet unwashed, and must be cleansed in a strong fire.

CHAP.  
IX.  
Section.  
2.  
Retorts.

How, this is further to be done, is to be seen in great *iron Retorts* when the *Sulphur* becomes *red*. But this is to inform the Reader, That all flints burnt in *iron Retorts* to *Sulphur* do yield *red Sulphur*, which *Painters* use to lighten yellow or *orange Colours*, but the manner of making *Sulphur* with great *Retorts* do not appertain to this *Treatise*, therefore I have named it only for the *Proof-sake*.

3.

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## CHAP. XII.

How to prove Black Coppers by defty or smooth Coppers.



ALL Coppers come *black* out of the *Oars* upon melting, yet some much finer and cleaner than others, which must after be cleansed and made ready, as they which contain no silver, and not purified, must be made ready and deff:

Also to know certainly how many *Centners* of it after

S ff

clean-

CHAP. XII. of Copper Needles. cleansing it yields of clean Copper (which must be proved in a little Fire.) Some think it may be known by special copper *Touch-Needles*, made on purpose: but because the *black-Coppers* are not all alike, but some *iron-streamy*, some *tinny*, *spizy* or *leady*, I cannot certainly determine concerning such Proofs: But the best way is thus, First, cut off from the cast *Copper Ingot*, and weigh 2 or 3 *Centners* of it, and lute a *Test* with small ground *leady Glass*, put the weigh'd *Copper* in it, and blow it in a fresh coal fire, till it hath a clean *green copper Colour*, then presently, take the *Test* out of the Fire, and take the *Copper* out of the *slacks*, and quench it off, then cut it asunder with a *Chissel*, and you will see whether it be good: then weigh and count how much the inset *black Copper* hath yielded ready *Copper*.

<sup>2.</sup>  
This Proof  
not certain.

This proof, although the *Copper* be surer to be found, than by the *Touch-Needles*, yet 'tis not certain to ground upon; because the Proof is small and the *Copper* little, therefore very easily the Fire may take away somewhat too much if it be over-burnt, which in great Works cannot be done, and so somewhat more of red copper will be brought out.

If you will have the right proof, and know the right Content, the same must not be esteemed too great a Labour, to make more than one Proof of the *black-Copper*, and then take the middle out of it.

You may use to this Proof, *Borax*, which cleanseth the Metal much, and brings the copper to be sooner ready: but, because one cannot use *Borax* in the great Works, it were better this proof (especially *iron-streamy Copper*) might be helpt with a little clean *Lead*, because 'tis used in cleansing: and the copper will become *leady*, which doth much cleanse the *Copper*, but if the copper be *leady*, then there needs no *lead* to be added.

<sup>3.</sup>  
Another  
Manner.

Some *Assayers* use this Method in their Proofs, viz. They

They take a Test which is made moist, and make a little hearth in it of *Coal Powder*, mixt with clay, having a flat smooth hole cut out: upon this they set the copper which is to be proved, and blow it with the Addition of a little *Lead-glass*, this will the sooner make it ready, but I think there is small difference in what ever is driven off from it: but be sure you drive not the copper too hard, and yet let it be of a right copper or *black* colour.

And, because many times copper - flints are to be found, in which almost the half is *Tinn-stone*, and if copper be melted out of it, it would be very *tinny* and *spiky*, also if it were done among other coppers, all would be spoiled in the cleansing. To prevent this, there is a particular way, *viz.* that by beating and washing one may separate both Mettals by *bucking* or *cleansing*, and then melt every part asunder, and bring it to profit: of which way I should write something here, but because I do not give a full Instruction in these my Books of the great Works (*viz.* of *Bucking*, *Washing* and *Smelting* Metal Oars) but only lesser Works, therefore I will here end, till another more convenient time, when they may be further discoursed of.

Section.  
4.  
Copper flint  
and Tin  
stone may be  
Seperated.

## CHAP. XIII.

*How to prove whether Lead be very Copperish.*



If you think your *Lead* have much *Copper* with it, and would be assured thereof, Then weigh with the great weight a *Centner* of the *Lead*, put it upon a very flat *Hearth*, and make a small fire of *Wood* upon it, lay also a green wood

*A flat  
Hearth.*

before

CHAP. XIV. before, that the *Lead* may go and very gently pass away under the before laid wood : Now, when such *lead* hath copper in it, if only two pound in a *Centner*, so the copper will remain on the hearth, and what you find is but *leady* copper, but if you will have it very clean, then blow it with a *Bellows* upon a hearth, till it becomes ready, but in the little proof, 'tis seen upon the *Coppel*, for when the *Lead* which hath much, begins to go, then touch the *Copper* flowers, and the *coppels* will become black after 'tis gone off.

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## CHAP. XIV.

*Twelve necessary Instructions for an Assayer to follow.*

Section.  
1.



FIRST, whether *Iron* doth become *Copper*? to which the Reader shall have this *Answer*, That I have a long while supposed, because the *Iron* in the *Coppery waters*, as in *Vitriol*, *green Argol*, and such like, do precipitate the *Copper*, that the *Copper* only is precipitated in such *iron water*, and not the *Iron* it self becomes *Copper*, yet I have seen in *Vitriol Mines*, (in a *Mine* called *Hesper*) when the *nails* and other *Iron Pins* fixt in the *copper-Oar*, by length of time have become a good *Copper* mearly by *Penetration*; therefore I must conclude, That the *Iron* doth become *Copper*; for though in the *Vitriol*, and other *copper waters*, the *Copper precipitateth* the *Iron*, yet there is not so much of it therein, as to turn it to *copper*: only know this, That while the *Iron* in such *Coppery waters* doth precipitate the *copper*, so the *copper* will precipitate the *Silver* (if it be in it) therefore 'tis fit, that to the com-  
mon

mon precipitation of *Silver* in the *Aqua fort.* that the copper with *iron* pieces or *lamins* be put into the cleansing (as above is mentioned) with which the *Copper* and *silver* are precipitated, and what hath been in the *Aqua fort.* cometh out whole.

CHAP.  
XV.

CHAP. XV.

Twelve Directions how to separate Silver from Copper in the great Work.



TO separate thus is a curious ART, which for many years the *Refiners* have kept as a great Secret, how the *Precipitations* are to be made right. But because the large Works are very great, therefore it could not remain secret, but is now known; yet there is still a difference, for in one *Furnace* it is better refined, and the prepared copper is made purer than in the other, also the Additions are not every where alike, and then many sorts of *coppers* cannot be refined all in one way, therefore for their sakes, who either know nothing, or but a little of such things, I will write somewhat as a tendency to that *Art*.

First, observe whether the *black Copper* be weak, dest, hard or brickle, for if they be weak and brickle before the refining, then the *Silver* will not come so soon out, but if one will give it its just due and heat, then the copper will flow under the *lead* through the *Oven*, and may cause hurt; therefore to the weak *Coppers*, there is no better way than to mingle other hard or brickle copper among it, that the one may hold the other.

Secondly, one must be instructed how much the *Copper* holds in *Silver*, by a diligent Proof, for according to it, the *Copper* must be mingled with *lead*. And if

T t t

the

Section!

1.

2.

One way of  
Preparati-  
on doth most  
serve for  
Copper.

3.

4.

CHAP. XV, the Contents be unequal as from 24 *Loths*, to 14, 8, or 10 *Loths*, then it must be made into a *Cake* by weight, near 27 pounds and an half of rich Copper, and 55 pound of poor Copper, upon this make your Account, how much *Silver* is in this 3 quarters of the *Centners* of Copper, and how much the *Lead* containeth which is to be used to the Addition, and then to every *Loth* of *Silver* which is in the *copper* and *lead*) 17 pound of *lead* is also to be counted; and thus, of the refined *lead* (which is to be parted from the *copper*) a *Centner* will not contain above six and a half, or at the highest seven *Loths* of *Silver*. But if the refined *lead* should contain more than 7 *loths*, it is a sign that the *Cakes* remain too rich, and that the *silver* is not all come forth of the *copper*, and that there was not *lead* enough to the Addition.

Section.

5.  
How much  
Lead to be  
used.

6. But, that one may know how 'tis with the Additions upon every *Copper*, and what is to be observed in the refining *Furnace*, I shall demonstrate it by Examples.

7.  
A profitable  
Rule.

Take two *Centners* of *lead*, and three quarters of a *Centner* of *Copper* (of a rich and poor Content) either weak, hard or brickle, one among another, if therein is not 12 or 12 and an half *loths* of *Silver*, then take *lead* Oar or other *lead* to it which is *silvery*, that you may have the above mentioned *silver* in the *fresh* piece, and then add *Lead*, or *Littarge*, as much that there may come to four pieces, 8 *Centner* of *Lead*, and three *Centners* of *Copper*, and of this there will come out in parting 6 *Centners* of refined *lead*; every *Centner* of which contains 6 *Loths* and a half of *Silver*, the other *Silver* and *lead* will remain in the *cakes* and *lead*, which will almost all come to profit again, as you will hear hereafter.

8. Another Addition upon two and a quarter of a *centner* of *Lead*, viz. take three quarters of a *centner* of *copper*  
per

per, and if there be not in it 15 or 16 *lots* of *Silver*, then take to it *rich lead*, which may enter in a fresh piece of such *Silver*: or, Take fresh and hard *lead* and *Litarge*, so that from 4 *Pieces* (upon an *Oven*) may come 9 *centners* of *Lead*, and 3 *centners* of copper, of this there will be 7 *centners* of refined *Lead*, of which a *centner* is to contain 6 *lots* and a half of *Silver*.

CHAP.  
XV.  
Section.

Also, take two and three quarters of a *centner* of *Lead*, and three quarters of a *centner* of *copper*, and if there be not 18 or 19 *lots* of *Silver*, then take *rich lead* that it may reach the *Silver* and *Litarge*, and hard and fresh *lead*, so that (upon an *Oven*) in 4 fresh *Pieces* may come 11 *centners* of *lead*, and 3 *centners* of *copper*; and in dividing of this again, there will be 9 *centners* of fine *lead*, and one *centner* is to contain 6 *lots* and an half of *Silver*.

Or take three *Centners* of *Lead*, and three quarters of a *Centner* of *Copper*, if there be not therein 20 or 21 *lots* of *Silver*, then take *rich lead* which came in a fresh *Piece* of the *silver*, viz. from 4 *Pieces* (in one *Oven*) 12 *Centner* of *lead*, and three *Centner* of *Copper*, and when this shall be separated, then 10 *Centner* of pure *lead*; and one *Centner* will contain seven *lots* of *Silver* in the *Keinstocks* and *Thornells*, and there will remain 15 or 16 *lots* of *Silver*, and they are further to be wrought, as hereafter will follow.

But if there be very rich, or much other rich copper, and little of the light Contents, and that you cannot reach the right Addition, as above mentioned, then one must oft times add a rich fresh piece, viz. to three quarters of a *Centner* of rich copper add three *Centner* of *lead*, and so the separating Work will prove rich: and although the *Keinstocks* may also remain rich to 4, 6 or 7 *lots*: yet they may further be added to the rich *Copper*, and the fresh pieces be so right, that the

re-

CHAP. refining *lead* may come out upon the true content, at  
 XVI. six, or six and a half, or seven *lots* of *Silver*, at the  
 highest.


Section.  
 12.

But, if there are poor contenty *coppers* (not to be reckoned with the rich) yet you must do with them as before; but never take more than three quarters of a *Centner* of *Copper* to two or three quarters of a *centner* of *lead*, and if such *black copper* contains 8 *lots*, the *centner* of the separating work will contain two *lots* and an half of *Silver*: and the poor *separating lead* which comes from *poor fresh* may be added again to other *fresh pieces*, (as by the following Instructions may be seen) but there is no help for it, and, if possible, the poor *fresh lead* may be left alone.

---

CHAP. XVI.

Thirteen *additional* Instructions about good *Copper*.

1.  *TEM*, One piece shall have 2 *Centners* and an half of *Lead*, and three quarters of *Copper*, and there shall be no more in one piece than 18 *lots*.

2. *Item*, Three quarters of a *Centner* of fresh *Copper* to 21 *lots*, and three quarters of a *centner* of *Lead*: to three *lots* and a half, half a *centner*: to two *lots* three quarters of a *centner* of fresh *lead*, and a *centner* of *Litarge*: thus you have four Pieces of 77, and a half *lot* of *silver*, in 11 *centners*.

3. *Item*, Three quarters of a *centner* of *copper* to 18 *lots*, and an half *centner* of *lead*: to four *lots* and an half, three quarters of a *centner*: to three *lots*, one quarter of a *centner*: to two *lots*, one quarter of a  
 cent-



centner of fresh, and one centner and 18 pounds of CHAP.  
*Litarge*, mingled in 74 *loths* of lead, do yield 10 : and XVI:  
 a quarter and an half of a centner of lead. Section.

*Item*, Half a centner of copper to 15 *loths* of *Sil-* 4.  
*ver* content; and one quarter of a centner to 20 *loths*,  
 and one centner of lead: To 4 *Loths*, half a centner:  
 To two *loths*, one quarter of a centner of fresh: one  
 centner of *Litarge* leaded in 70 *loths* of *Silver* doth  
 yield 10 centners of lead.

*Item*, Half a centner of copper to 15 *loths*: one quar- 5.  
 ter of a centner to 17 *loths*: one centner of lead to 5  
*loths*: half a centner to one loth and an half; one quarter  
 of a centner fresh; one centner of *Litarge* leaded in 70  
*loths* will yield ten centners of good lead.

*Item*, Three quarters of a Centner of Copper to 17 6.  
*loths*: one centner of lead, to 4 *Loths*: one dram, one  
 quarter of a Centner to 4 *loths* and an half: one quarter of  
 a centner to one loth and an half: and one quarter of  
 a centner fresh, one centner and 18 pound of *Litarge*  
 leaded in 74 *loths* yields 10 and an half centners of lead.

*Item*, Three quarters of a centner of Copper to 18 7.  
*loths* and half a centner of lead: to three *loths* and an  
 half, a quarter of a centner: to four *loths* and an half  
 three quarters of a centner: to three *loths* one quarter  
 of a centner: to two *loths* one quarter of a centner of  
 fresh, and one centner of *Litarge* leaded in 76 *loths* and  
 a half yields 10 centner of lead.

*Item*, Three quarters of a centner of copper to 16 8.  
*loths* and half a centner of lead: to 3 *loths* and a half:  
 three quarters of a centner: to four *loths* and an half: one  
 quarter of a centner: to two *loths* one quarter of a cent-  
 ner of fresh: and one centner of *Litarge* (or instead of it,  
 three quarters of a centner of fresh) leaded in 70 *loths*  
 and a half do yield 10 centners of lead.

*Item*, Half a centner of copper to 19 *loths*: and a 9.  
 quarter

CHAP. quarter of a *centner* to 7 *loths* : one *centner* and a half  
XVI. of *lead* to three *loths* and a half : and half a *centner* to  
one *loth* and a half ; and one *centner* of *Litarge* leaded  
in 69 *loths* and a half, yieldeth 10 *centners* of *lead*.

Section.  
10.

Item, Half a *centner* of *Copper* to 19 *loths* : one  
quarter of a *centner* to 16 *loths* : one *centner* of *lead* to  
4 *loths* : one dram and half *centner* to one *loth* and a  
half : one quarter of a *centner* fresh, and one *centner* and  
18 pounds of *Litarge* leaded in 74 *loths* do yield 10  
*centners* and an half of *lead*.

11.

If there be no *Litarge* to be had, then take half a  
*centner* of good *copper* to 9 *loths*, one quarter of a  
*centner* of *copper* to 30 *loths* : one *centner* and a quar-  
ter of *lead* to 4 *loths*, and an half *centner* to one *loth*  
and an half, and a quarter of a *centner* fresh : thus make  
all times the additions upon the hard *lead*, that there  
may be in a piece 10 *centners*, 10 and an half, or 11  
*centners* of *lead*, also the *silver* in 4 pieces, 70, 72, 74,  
75, 77 *loths*, thus the *lead* doth contain 7 *loths* of *sil-*  
*ver*, happily one dram more or less.

12.

Item, Three quarters of a *centner* of fresh *copper* to  
20 *loths* : three quarters of a *centner* of *lead* to 4 *loths* ;  
and half a *centner* to two *loths*, and one *centner* of *Lit-*  
*targe* : and half a *centner* of fresh *lead* leaded in 76 *loths*  
yields 10 *centners* of *lead*.

13.

Item, Three quarters of a *centner* of *Copper* to 21  
*loths* : three quarter of a *centner* of *lead* to three *loths*  
and an half ; and half a *centner* to two *loths* : and half  
a *centner* of fresh *lead*, and one *centner* of *litarge*, or  
three quarters of a *centner* of fresh *lead*, leaded in 77 *loths*  
and a half do yield 10 *centners* of *lead*.

CHAP.

CHAP. XVII.

Six additional Instructions about proving of fresh Oar,  
called hard Lead.



ITEM, Three quarters of a centner of  
Copper to 11 *lotbs*; and half a centner  
of fresh lead; 2 centner of *Litarge* is  
leaded in 8 centners, into 4 pieces, con-  
tain 33 *lotbs*.

Section.  
1.

Item, A half centner of copper to 8  
*lotbs*; a quarter of a centner to 15 *lotbs* : one centner  
and a quarter fresh, is leaded in 8 centners, into 4 pieces  
contain 31 *lotbs*.

2.

Item, Half a centner of copper to 15 *lotbs*; one quar-  
ter of a centner to six *lotbs*, three quarters of a centner to  
two centners of *Litarge* leaded into 9 centners, into 4  
pieces, contain 36 *lotbs*.

3.

Item, Three quarters of a centner of copper to 11  
*lotbs* and a half, and half a centner of fresh; and two cent-  
ners of *Littarge* leaded in 8 centners, into 4 pieces, and  
contain 34 *lotbs* and a half.

4.

Item, Half a centner of copper to 13 *lotbs*: a quar-  
ter of a centner to 10 *lotbs*: half a centner of fresh, two  
centners of *Litarge* leaded in 7 centners, into 4 pieces,  
contain 36 *lotbs*.

5.

Take notice, if the Copper be very poor, then you  
may add such lead, as doth contain one and a half, or 2  
*lotbs* of silver.

6.

CHAP.  
XVIII  
XIX.

CHAP. XVIII.

Three Additions concerning Thornells, or parts of Oars not fully melted.

Section.  
1.



TAKE two Centners and an half of Thornells, that is half separated Oars, and half roasted, and a centner and a quarter of hard Lead: and a quarter of a centner of *Litarge*, the Lead must contain 3 and a half: 4 *lots*, 4 and a half, till to 5 *lots*.

Item, to a Centner of *Littarge* is counted 3 quarters of Lead; and a Centner of *Littarge* is counted at 135 pounds; and also upon 145 pounds of hard Lead, one centner of soft Lead, although to some separating Works are taken 130 pound of *Litarge* in stead of a centner of Lead, and 140 pound, hard Lead, instead of soft lead.

Also there goes commonly off from 10 centners one centner and a half of Lead; thus you may know how to subtract from the additions together with the *Lots*, which will be found in the centner.

CHAP. XIX.

Six more Instructions concerning good and deff Coppers.

1.



TAKE, Take Copper to 11, 12, 13, 14, 15, 16, *Lots*, and of this one may make hard Lead, being commonly taken as Additions: of which 65 pounds will yield at all times in 4 pieces 39 *lots* of Silver; but if it be not enough

enough (with the 65 pound of Copper in the Content) then one may take of the Copper three quarters of a Centner, and at all times upon one loth of Silver 29 pounds of lead, and this will make in one piece, three Centners four pounds of fresh lead, and in four pieces, 12 Centners, and 16 pounds, in which are 42 *lots* of Silver.

CHAP.  
XIX.

Item, 65 pounds of Copper to 15 *lots*: one centner and a quarter of a centner of fresh lead, and 305 pounds of *Litarge*, there will come upon 4 pieces 11 centners 31 pounds of lead, in which will be 39 *lots* of Silver; and if one doth sever it in an Oven, and with such Additions, there will come out of it 9 centners of lead, which will contain to three and three quarters of a *loth*, or three *lots* and a half: this is together, 33 *lots*, three drams; so there will remain in the *Thornells* and *Keinstocks* five *lots* (if well wrought) but it consumes much lead by it.

Section,  
2.

If the Copper contain 18, 19 or 20 *lots*, 'tis usual to take sixty or sixty five pounds of Copper, according as one hath poor or rich lead, and the Addition is made thus, that together in 4 pieces, may come 75 *lots* of Copper and lead; and upon this 75 *lots*, is taken one *loth* and 15 pounds of lead; if then one do sever it in an *Affay-Oven*, it will yield 9 centners and an half of lead; and this will contain 6 *lots* and a half, or six *lots* three drams, and then there will remain in *Thornells* and *Keinstocks*, 11, 12 or 13 *lots*, but how the Additions are to be made, is hereafter specified.

3.

Item, One piece shall have (with lead and copper,) 3 Centners, 25 pounds, and four pieces; together 13 Centners, and of lead 11 Centners, 25 pounds, so there will come in one piece 65 pounds of Copper, to 17 *lots*; and two Centners and a half of lead to three

4.

X x x *lots*;

CHAP. *lotbs*; yet the 4 pieces will contain no more in *copper* and  
XX. *lead*, then 75 *lotbs*.

Section.  
5.

Item, 65 pounds of *Copper* to 18 *Lotbs*, make 47  
*Lotbs* addition in the *Lead*. Take one *centner* three  
quarters of *Lead* to 4 *lotbs*, they do bring in 4 pieces;  
28 *lotbs* one quarter of fresh, and 30 pounds of hard, so  
there will come 11 *Centners*, 25 pounds of *lead*, in 75  
*lotbs*.

6.

But the *Thornels* which are to be severed from it,  
must have this Addition, Take to one piece, one *centner*  
and a half of *lead-Thornels*, 1 *Centner* of roast *Thornels*,  
1 *centner* 18 pounds of hard, and one quarter of a *centner*  
of fresh *Lead*, and 30 pounds of *Litarge*, then the *lead* will  
commonly contain 3, or 3 and a half, to 4 *lotbs* of *silver*.

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## CHAP. XX.

Seven more *additional* Instructions about good *Copper*.



ITEM, if one take to a piece of 80  
pounds of *Copper*, which may contain  
15, 16, 17, 18 or 19 *lotbs*, and so there  
will be of 4 pieces, ten *Centners* of *lead*,  
and so in one piece, 2 *Centners* and an  
half, the process is thus, Take one *Cent-*  
*ner* of *Litarge*, one *centner* and a quarter of *lead*, to 4  
*lotbs*, one quarter of *hard lead*, and a quarter of *fresh*  
*lead*, as it happens, yet that in 4 pieces will come to  
no more than 72 *lotbs* of *Silver*, and take to one *lotb*  
14 pound of *lead*, and this in one piece will be two *Cent-*  
*ners* and a half, and 2 pounds of *lead*, yet 'tis always bet-  
ter to take much *Litarge* and little *lead*, for the *Litarge*  
doth draw better to it self the *Copper* than the *fresh lead*,  
likewise much *Copper* than little, and so the *lead* will not  
consume

consume so much, and there will be wrought much more  
*copper* with less *lead*. Therefore if you take 65 pounds  
 of *copper* to one piece, then there will be to four pieces,  
 eleven and a quarter of a *centner* of *lead*, and one melt-  
 ing may make just so many pieces. But if you do  
 take 80 pounds of *copper*, for 65 pounds of *lead*, then  
 there will remain in the *Thornels* and *Keinstocks*, 10, 11,  
 or 12 *lots*.

CHAP.  
XX.

Item, Take 75 pounds of *Copper* (rich or poor)  
 and in four pieces 72 *lots*, that upon one *lot* may  
 come 14 pounds of *lead* into four pieces, 10 *Centners*,  
 8 pounds of *lead*, and this doth yield commonly good  
*Keinstocks*, and if this be thus severed, then the *lead* of  
 it will contain 7 *lots* of *Silver*, and a dram more or  
 less.

Section:  
2.

Item, to make *hard lead*, take 65 pounds of *Copper*  
 to 19 *lots*, and 200 pounds of *Litarge*, and 190 pounds  
 of *hard lead*, and 40 pounds of *fresh lead*, to two *lots*;  
 and thus there will be in 4 pieces 52 *lots*, and one dram,  
 and ten *Centners*, and 80 pounds of *lead*.

3.

Item, take 75 pounds of *Copper* to 16 *lots*, and not  
 more than 48 *lots* in 4 pieces, and to one *lot* 21 pounds  
 of *lead*, that the most part may be *Litarge*, so the *lead*  
 will contain 4 *lots* and a half, or 5, and remain in the  
*Keinstocks* 6 or 7 *lots*.

4.

In brief, to *fresh Copper* one may take three quarters  
 of a *centner* of *Copper*, and two *Centners* and an half of  
*lead*, and in four pieces not above 34 *lots*, this doth  
 well; and to the *hard lead*, three quarters of a *Centner* of  
*copper*, two and a quarter of a *centner* of *lead*, and no  
 more, and it will bring into it 33, 34, to 38 *lots* of  
*Silver*.

5.  
Fresh Cop-  
per.

Concerning the poor coppers (they are partly seve-  
 red in *Hungary*, and contain to five, six, seven, eight  
*lots* of *Silver*, or nine at the highest) they must be so  
 severed

6.  
Hungarian  
Copper.

CHAP. severed, that the severed *lead* may come upon the right  
 XX. Content, as a centner upon six to seven *lots* of *Silver*,  
 so the copper will be good, and if you add *lead* accord-  
 ing to the Content, the copper will not have *lead* enough,  
 and the *Silver* will not come all out, and the *Keinstocks*  
 will remain rich.

Section.

7.

Now, when the *Melter* makes the *fresh Pieces*, then  
 must all their Additions first be weighed upon every  
 piece apart, and then he must put the *Copper* and *hard*  
*lead* first in, and afterwards the *Litarge*; and lastly, the  
*lead* in the *Oven*, and when the Division of one part is  
 almost gone down, put after it a quantity of *slacks*,  
 that when he seeth the same, he may know how much  
 hath been weighed (in one piece) out of the *Oven*, before  
 he put in the other, and when that goes down in the  
*Oven*, pour the first piece out of the furthestmost *Cruci-*  
*ble* into the pan, and then take care that one piece may  
 not be heavier than the other, and so he must still labour  
 till he hath cast all the pieces (as such practise will shew)  
 But how the *fresh Oven* is formed, and the *fresh pieces*  
 cast, you may see in the *Sculpture* following, thus

Deciphered.

1. *Copper and Lead in pieces, weighed.*
2. *The Oven for Assaying those pieces of fresh Oar.*
3. *The Copper-pan into which those fresh pieces are to  
 be put and melted.*
4. *The fresh piece melted.*
5. *The Melter.*
6. *The Vault in which the Dust and Smoak is received.*
7. *The little door out of which the dust is to be cleansed.*

Sculpture.



Of Copper Oars.

Sculpture XXXI.



CHAP.  
XXI.

## CHAP. XXI.

Nine Rules, shewing how the Regulus of poor black Copper-Oar is to be assayed, after the Hungarian Method.

Section.  
1.



IRST, I will mention how the poor Coppers are to be split before their melting in the separating Works, and the content made rich, that they may the better be melted and separated.

2.  
The Melting Oven  
for them.

Item, in the Sheds or Houses where black Coppers (which commonly contain 5, 6, or 7 *lots* of Silver) are used to be smelted there, the melting Oven for them is formed like a driving harth with a Vault, and in the fore-part thereof the fire is to be made of Birch, or other small split fire-wood (as is used in Kitchens) and the melting oven must have a Crucible before it, in which the black Copper (when 'tis wrought enough and becomes good Copper) may run out of it: On the other place of the Oven are the slacks done off, and the Bellows are not to blow in the midst of the Oven, but on an iron Pipe, which is directed against a corner of the Oven, in which the Wind may blow, so that it may go through the Pipe into the spleifs Oven in the midst of it upon the copper.

3.  
If you will smelt them, then put into the smelting Oven 38 centners of black copper, of which the centner contains six *lots* of Silver) when this is smelted, let the slacks go off from it; that it may be 11 to 12 centners, then 4 to 4 centners and an half, in which you must be diligent, that you may know how to give it its due heat. After open the smelting Oven near the foremost Crucibles, and  
set

set the copper in it, and smelt of the 38 *centners* of black copper, out of the Crucibles 18 to 19 *centners* of good and rich copper, but of the smelted Copper, every Cake is to be cut out, and cast into Ingots, of which a *centner* holds commonly near 9 *lots* of Silver, the remaining Silver you will have in what is swept off, and in the *slacks*, as follows.

CHAP.  
XXI.  
Section.

But because much smelting at once (as in great works) is counted by the *Smelters* a Work for half a week, therefore to this belongs a Master and a Servant, and they cannot work but twice a week in an Oven, and to such Operating in one work, there is to be used near 4 layes of Wood.

4.

The *slacks* that come from the above-mentioned black *Regulus*, or which are twice done from the copper, must be beaten small as *Walnuts*, and smelted through a smelting Oven, then draw the *slacks* off again from it in the *crucible*, and out of it you will have a red *Regulus*.

5.  
Red Copper  
Regulus.

Of this red *Regulus*, one must take 40 *centners* for a smelting Oven (as above is signified) and may smelt of it 30 to 31 *centners* of red Copper, and of this the *centner* contains two and a half, to 3 *lots* of Silver, which cannot all be brought out, therefore it must be forced out with an *hammer*. But if it be made to sell for Bells, then there must be smelted of this 40 *centners*, or 33 *centners* to 35 *centners* of red Copper, and to this one needs but one Oven, 2 to 2, and half the proportion of wood, and 'tis counted by the *Smelters* for two Works for a Week, as upon the *black Coppers*.

6.

But the *slacks* which (of this 20 *centners* of *Regulus*) are to be done off out of the smelting Oven (and happily 6, 7 *centners* to 7 *centners* and an half) they are to be beaten asunder and smelted through a smelting Oven, and one may draw off the *slacks* in the *Crucible*, and make of a *Cobolt Regulus*, or *Copper-stone*, 40 *centners* upon a smel-

7.

Cobolt Re-  
gulus.

ting

CHAP. ting Oven, and smelt it off from 32 to 34 centners of  
 XXII *Liebeter* or speizy or unclean Copper, of which a cent-  
*Liebeter or* ner contains one, or one and an half *loth* of Silver.  
*spizy Cop-*  
*per.*

8. Now when all is smelted off, then take that which re-  
 mains upon the *brim* of the driving harth, also that which  
 is about the *crucible*, and some good *slacks*, and beat them  
 small with the *stamp*, upon which the water doth run,  
 and then the good copper will fall on the ground, and that  
 is to be gathered and washed and then settled: and, if  
 it be at hand put 12 to 14 centners upon the *smelting*  
*Oven*. Likewise happily 5 or 6 centners of *leady-Cop-*  
*per* which remain'd upon the *harth*; and if the copper en-  
 ters in it, and will not out again, then put to it 18 centners  
 of black *Regulus*: and smelt again 20 centners of *stamp*  
*Copper* (which *Copper* is to contain 12 to 13 *lots*) and  
 this same, being thus assayed, one may set it upon the  
*driving* harth, and drive it off with the poor and rich  
*lead*.

*stamp*  
*Copper.*

What comes off at last from the stamps in the *casting*  
 and settlings, is also to be taken up, for 4 centners of this  
 will yield a centner of copper, and such is to be smelted  
 with the *slacks*.

---

## CHAP. XXII.

Seven more Instructions for the Hungarian way of sepa-  
 rating, and how the first work or Instrick is to be  
 performed.



O the first *Instrick* (by which you must  
 understand the first *Schicht*, work or  
 operation which a Master with his Ser-  
 vant can smelt in 8 or 9 hours) they do  
 take 30 centners of rich or good *Copper*  
 and fresh *lead*, which comes from *Crac-*  
*can,*

*can*, of which a *centner* contains near one *loth* of *Silver* ( CHAP. XXII ) 110 *centners* : in all 140 *centners* of Copper and *lead*: out of which work will come 40 pieces, this being put out of the former *Crucible* into a copper pan, there will come upon one piece of rich and good Copper, three quarters of a *centner* ; of *fresh lead*, two and three quarters of a *centner* : And every Smelter must observe, That the Addition of every *piece* come only to one piece, and that the piece may be cast equal, that to the whole work may not come more or less pieces than were weighed to it before ( as above is signified ) the *slacks* are afterwards to be drawn clean off, out of the foremost *Crucible*, and smelted again in the *Oven*, and out of this will come *slack-lead*, and the *centner* will contain one *loth*.

But the above-said 40 pieces are to be assay'd so that always five pieces be set upon the *Assay-Oven*, and the *lead* which flows out of it (being in a hole) is afterwards to be cast into little *copper pans*, and the *Centner* of the same *lead* (according as the copper is rich) will commonly contain 2, to 2 *lots* and a half of *Silver*; and that which remains upon the *Assay-Oven* is called *Keinstocks* (which are pieces yet undry'd or unroasted, and what falleth down from the *Assay-Oven*, and between the *roast-Oven* are called *Thornels*, of which *Thornels* they do weigh 80 or near 100 pounds. Section. 2.

These *Thornels* are thus to be made to profit ; Take 20 *Centners* of them from the *Assay-Oven*, and 20 *centners* from the *roast-Oven*, and 40 *centners* of hard *lead*, and *Litarge*, of each sort half; (in the whole 8 *Centners*) out of this there will come from the Work 20 pieces : and there will come upon one piece 2 *Centners* of *Thornels*, and 2 *centners* of *hard lead* and *Litarge*, for it must be thus distributed upon the *pieces*, and the *slacks* upon the foremost *Crucible* must be drawn off 3. Thornells.

Z z z clear

CHAP. clear, these are to be smelted apart, and out thereof will  
XXII come the *slacks* of *lead*.

Section.  
The first Inlay.<sup>4.</sup> Afterwards 5 pieces of these 20 pieces of *Thornels* are alwayes to be set upon an *Assay-Oven*, and assay the *lead* of it, of which a *centner* will contain near 2 loths of *Silver*, and the *Keinstocks* will remain above, and what falleth down betwixt the *Oven* is (called, as is said, *Thornels*) and they do weigh near 8 pounds, as above is mentioned.

The second Inlay.<sup>5.</sup> To the *second Inlay*, by which you must understand the second *Work*) the Additions are to be made thus, they do take rich or good broken *Copper*, 20 *centners* and 20 *centners* of *Thornels* from the separating and roast *Oven*, one with another, and 20 *centners* of *Litarge*, (in the whole 60 *centners*) out of this comes 40 pieces, so there is to each piece half a *centner* of good *Copper*, and half a *centner* of *Thornels*, and half a *centner* of *Litarge*, and these are to be set (as before) always 5 pieces upon a separating *Oven*, and assay'd, and the *Lead* of it is to be cast into little *copper pans*, and the *centner* will contain 3 and a quarter, to 3 loths and a half of *Silver*, and the *Keinstocks* will remain in the separating *Oven*, and the *Thornels* fall down: Now, this is not used in the common work, but only when rich *Copper* is to be taken to the work, or the store doth increase.

The Third Inlay upon rich Copper.<sup>6.</sup> To the third *Work* you must understand the third measure, which is called *Rich putting in*: the Additions are to be made thus, Take 30 *Centners* of rich and good *Copper*, and of the *Thornels* of *Lead*, 120 *centners* (in the whole 150. *centners*) then smelt all through the *Oven*, and draw the *slacks* clean off, and of these will come 40 pieces, and of one piece will come three quarters of a *Centner* of *Copper*, and three *Centners* of *Lead*, and these 40 pieces are to be assayed, and every time set 5 pieces on a separating *Oven*, and the *Centner* of this  
lead

lead will contain near 3, and three and a half *loths*, and of this there will also come *Keinstocks* and *Thornels* like as of the second Work.

CHAP.  
XXIII.

Section.  
7.

But to this third Work or Inlay, To one piece is to be taken a quarter of a *Centner* more of *lead* than to the first; the reason is, because to the first there hath been added *Crackaw* lead, which hath contained *Silver*: secondly, because it is *Copper*: and thirdly, That so the rich works in the *lead* (which in the working are become *Coppery*) may also be included.

## CHAP. XXIII.

*How Litarge Pieces are to be made.*



LITARGE Pieces are to be made thus, First, their addition is upon a *Shich*, to 15 *centners* of rich copper add 15 *Centners* of *Thornels* from the *Assay-Oven*, 60 *Centners* of *Litarge*, and 37 *centners* and a half of *slacks* or fresh *Lead*, (in the whole 127 *centners* and an half: This stuff may be smelted in the *Oven* by a *Master* and his servant in 8 hours, and the *slacks* being clean drawn off, and then being cast into a pan, it makes 30 pieces; and in one piece, will be half a *centner* of rich *Copper*, and half a *centner* of *Thornels* from the *Assay Oven*, 2 *centners* of *Litarge*, one *centner* and a quarter of *slacks*, or fresh *Lead*.

i.

These mention'd 30 pieces of *Litarge* are to be assayed, and alwayes 5 pieces to be set upon the *Assay-Oven*, and out of this will come the *lead* which is called *Litarge-lead*, and one *Centner* will contain 2, to 2 and a dram of *Silver*, and there will come also out of the *Assay-Oven* *Keinstocks*, and *Thornels*, as in the second *Assay-work*.

2.  
*Litarge.*

Another

CHAP.  
XXIII.  
Section.  
3.

Another *Addition* upon *Litarge* pieces is this, They take 15 *centners* of *copper*, 15 *centners* of *Thornels* (from the *Assay Oven*) 90 *centners* of *Litarge*, 15 *centners* of *slacks* or *fresh lead* (the whole 135 *centners*) and out of this will come 30 pieces, and to one piece will come half a *centner* of rich *Copper*, and half a *centner* of *Thornels* from the *Assay-Oven*, and three *Centners* of *Litarge*, and half a *Centner* of *slacks* or *fresh lead*.

4. The before-mentioned 30 *Litarge* pieces are to be *assayed*, and set 5 pieces at once upon an *Assay Oven*, and the *Centner* of *lead* which comes of it will contain two to two *lotbs* and a quarter of a *lotb* of *Silver*: of this also there is *Keinstocks* and *Thornels*, as formerly hath been mentioned.

5.  
The last In-  
lay.

When all the before-written *assayed* rich and poor *lead* are brought together, they make this account upon it (whereby they may know to make an *Inlay*, (that is a quantity of it) so that a *centner* in the same *Inlay* of rich *Copper* and *lead* in the *assay'd lead* may contain 5 *lotbs* and a quarter of a *lotb* of *Silver*, and this *Inlay* is to be made thus. Take 26 *centners* and a half of rich *copper*, and 115 *centners* and a half of rich and poor *lead* (that they may come upon the before-mentioned reckoning) so that a *centner* may contain 5 and a quarter, or at most 5 *lotbs* and an half of *Silver*; what is done above, is with *dammage*, and the ready *copper* will become too rich: In short, 141 *centners* and three quarters of a *centner*, are also to be smelted through an *Oven*, and the *slacks* drawn clean off upon the foremost *Crucible*, and a *Master* and *servant* to make this *schick* or work into 42 pieces, so there will be to one piece 5 eight parts of a *centner* of the rich *Copper*, and of all the sorts of rich and poor *lead*, 2 and three quarters of a *centner*.

6. These now mentioned 42 pieces they assay upon an *Assay-Oven*, but no more at once than 5 pieces of rich



rich lead, that one centner with the other may contain CHAP.  
XXIV. 5 *lots* and a quarter of *Silver*, and there will remain also upon the *Oven Keinstocks* and *Thornels*, which are fallen down, such *Thornels* which come of rich *lead* they separate, for they are the best, and are to be used again, and to be laid among the *Litarge*-pieces: Upon this poor *Contenty Copper Assaying*, meditate with diligence, for 'tis a profitable *Instruction*.

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CHAP. XXIV.

*How Silver is to be separated from speizy and unclean black Coppers.*

**W**HEN the *speizy* and very unclean *Silver Contenty coppers* are to be separated from other good *coppers*, then they use the *prepared coppers*, which are dest of themselves, though they are brickle and unsmooth, and are not to be used to all sorts of *Works*: to avoid this, prepare to assay such degenerate *black coppers* as follows: Take such *black Coppers*, and dress them like a *black Licheter Copper* with help of the *lead*, by these means they will become clean and dest, and brought thus into compass, so that oftentimes of three *centners* hardly remains one, yet nothing of the *Silver* gone off, but what hath been before in the three raw *centners*, and this is to be found together, and then separate this *prepared copper*, with good *copper*, or by it self (as is usual) and in *Hungary* they use this care about the poor *Coppers*, though not very unclean, which in their separating is often try'd, and the *coppers* becomes rich by it.

But that you may see how the *copper Ovens* are  
A a a a
formed,

CHAP. formed, and how to assay upon them, this following  
XXIV. Sculpture will shew.

Sculpture XXXII.



Deciphered.

1. *The separating Oven as it stands fram'd.*
2. *The Supporters to it made of Copper, as they are to stand under the Oven.*
3. *The cast pieces as they are to stand in the Oven.*
4. *The Walls of the Oven (or the four sides of it) and the fire in it, and how the Oven is brac'd with iron hoops.*
5. *The stamp'd Pieces, and coals on the top of the Oven.*

6. *The*

6. The copper or iron little pans, with a man putting the melted stuff into them. CHAP. XXV.
7. The Keinstocks.
8. The Crane or draught by which the assayed pieces are to be lifted out of the assay-Oven, or otherwise disposed of.
9. Instruments, viz. Ladle, Picker, Fork and Hook.
10. The troughs or place to cool the Instruments in water.

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CHAP. XXV.

Instructions for driving Lead and Copper from Silver.

**I**F you have enough of that rich *Lead*, of which a *centner* contains 5 *lots* and a quarter of *Silver*, then prepare the driving harth, formed with a Vault like a great Bakers Oven, and lute it with all diligence, and lay 100 *Centners* of this lead upon it, and six *centners* of the richest copper, which is to be pick'd out of the harth of the *speize Oven*, of which the *Centner* contains 10 to 13 *lots* of *Silver*, (which is call'd the stamp'd *Copper*,) drive the work, but not quite off, and if it make *lead slacks*, then quench it and retain the same *lead slacks*, so in this will be near 50 marks of *Hungarian Silver*.

But there must be two driving-harths one near the other, and while you drive off the one work, the other must be prepared with diligence for the other, and then put upon it six *centners* of the richest *Copper*, and an hundred *Centners* of rich *Lead*, which contains 5 *lots* and a quarter of *Silver*, and drive off the work (as aforefaid) and when the *Silver* will almost go to it, then add the said *lead slacks* in which the 50 marks of *Silver* are

*Two drive harths.*

CHAP. XXVI. are, and let the work go quite off, thus you have 100 marks of Silver to 15 *lots* of fine. But such works are used to drive them off in 4 or five weeks, that commonly one week with another, is reckoned to make 125 marks of Silver, and 'tis needful to such a driving off, to have 4 layes of wood, and you must not feed the fire upon such driving harths with long *split-wood*, but (because the Oven hath a singular Vault) it must be fed with good dry *faggot-wood*, and let the *Bellows* go true upon the work.

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CHAP. XXVI.

*Of driving the Keinstocks and Thornels.*

Section.  
1.



EINSTOCKS are prepared upon the said *Assay-Oven*; and if it be of rich or poor *Lead*, or *Thornels* or *Litarge* pieces, put them together in a *driving Oven*, and let there be four such *driving Ovens*, and in every one 4 *Rows* or *lanes*: upon these you are to set all sorts of *Keinstocks*, near 120 *centners*, then make a *fire* of dry *split wood* before and behind the *Rows* of *Litarge*, and dry the *Keinstocks* about 12 or 14 hours, and that which runs first out into the *Litarge* rows (which will be but little) this pour out, and it is fresh *Lead*, and what remains of the *Thornels* will fall down in the rows, then they are to be melted to *thornels*, like those which are flowen out under the *melting Oven*.

2. *Item*, such *Keinstocks* which remain above those *Ovens*, are not to be boiled in the great *speize Ovens* (like the raw black *Coppers*) but must be beaten and knock'd that the *shiffer* and other uncleanness of them may be removed

moved, and then put them upon the *boyling harth*, and drive the copper to be pure, and when the *slacks* are clean drawn off, then split the *plates* or *cakes* one after another, this is ready and deſt copper, and ſo the remains that are in a *centner* of ſuch ready copper will be almoſt a loth of *Silver*, and one doth take to a *ſchick* 4 harths to contain near 18 *centners*; there are to be two ſuch harths or copper-ovens in the ſeparating houſes or ſheds, wherein you may ſpleize or work all working dayes.

Section.

3.  
Copper Re-  
gulus.

The *slacks* which are to be drawn off from the harths are to be melted again through a melt Oven, and a *Regulus* made of them, which is called a *copper Regulus*, which I judge to be like the *Copper*, made at *Swatk*, ſet them in a dry Oven and dry them off, from this the *thornels* will fall down into the *rows*, theſe muſt be melted into *thornels*, (as above is mentioned) for ſuch copper *Regulus* muſt not be wrought by it ſelf, for they are *ſpeizy*, therefore you muſt mingle them among the *Keinſtocks*, which are to be dried, and you may make pure copper of them.

Thus you have ſufficient Directions how *Coppers* may be aſſayed and ſeparated.

But concerning the reckoning which (alwayes in ſuch things) is neceſſary to be made known, I will not recite here, for every ones Practice will teach them, and the keeping of the Book is the ſureſt Rule for it. The next *Sculpture* is thus

Deciphered.

1. A drying Oven.
2. An Oven ſoon made according to the Hungarian way.
3. A common and ready Harth for drying.
4. Keinſtocks, as they are to be pick'd and beaten by a man.
5. Harths for the Hungarian ſpeizing or working.

B b b b

6. Copper

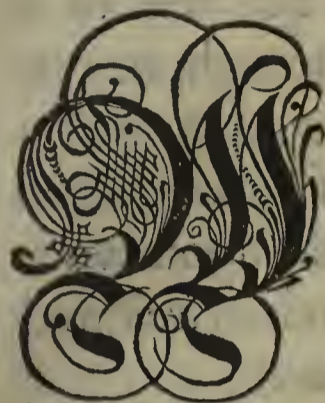
- CHAP. 6. Copper Cake, quenched in a Cistern of Water by a  
 XXVI. man, 6. 6. 6.  
 7. A Pipe and Tub that lets water into the Cistern.

Sculpture XXXIII.



## CHAP. XXVII.

*A singular way of melting in the Assaying work.*



WHEN flint or Copper Oars are intended for Copper, then the Oars are to be roasted well and stick'd through; and then to make it Copper it must be burnt and roasted again.

Section:

1.

In such work one may surely know the Content of the *raw stone*, and also by the Content of the Stone (which is *stick'd* through the little Proof) how much *Copper* and *Silver* is in it.

When the stone for making of *Copper* is perfectly prepared and burned; then take of this roasted Common proof (among some other) and prove it by 2 or 3 proofs upon *Copper*, and then the *Copper* upon *Silver*, and when the *Copper-stone* in the roast is of unequal content, it is not well mingled, yet you will find in the content, a very small difference; yea sometimes none at all, and then see whether the content of *Copper* (of the roast) doth agree with the content before, which is found in the through burnt stone.

Therefore try whether you have all the *Silver* in the *roast* which was in the *Copper-stone*, if there be a difference to 3 or 4 loths in a *Centner* against the other, then take the middle of it, and make your Additions thus; In case you have found in a prepared roast (through the little proof) that two *centners* contains three quarters of a *centner* of *Copper*, and a *centner* of this *Copper* contains twenty loths of *silver*. Then weigh of that which is melted 2 *centners* of the roast, and set them asunder, one *heap* after another, and of every

2.  
Copperroast3.  
Addition of  
parts.

ry

CHAP. XXVII. ry heap two centners of roast, and to every part weigh its due of *Lead*, that may alwayes come upon a *loth* of *Silver*, (which is in the *Copper* 18 *lots* of *lead*) or if it be good, 17 pound: and are to be weighed to the roast-heap which is weighed off, and because two centners of the roast do contain three quarters of a Centner of copper, (and must be melted through, to one piece) then after the common proof, three quarters of a centner of *Copper* will contain 15 *lots* of *Silver*; then weigh to it 15 times 17 pounds of *lead*, so upon every fresh piece will come two centners 35 pounds of *lead*, and one fresh piece will weigh 3 centners 7 pounds.

But 'tis to be observed (in making the Addition of the *lead*) that you must know what the *lead* contains, viz. whether the centner had 1 or 2 *lots* of *Silver*. Then upon the same *Silver* which the *lead* contains upon every *loth* must be counted 17 pound of *lead*; for the *Assay*-work must contain but 7 *lots*; if they contain more, 'tis a sign the *Keinstocks* is too rich, and the *Silver* comes not all out of the *Copper* (as is before mentioned) therefore if one hath *lead* which contains *silver*, such cannot be taken to the rich *Coppers*, for the fresh pieces are too great and receive too much *lead*; and the *Copper* will go through the *Assay*-Oven with the *lead* to loss.

Section. But if one have *copper-stone* or poor *copper* which may  
 Addition of 4. yield to 10 or 12 *lots*, to this it may be used; especially  
 parts. if it becomes good; then the Addition must be thus: If you find by the Proof, That 2 centners of the roast-stone contains three quarters of a centner, and one centner of the *Copper* 12 *lots* of *Silver*: then in 3 quarters of *Copper*, or in two centners of roast-stone there will be nine *lots* of *Silver*; to this add the due of *lead*, upon every *loth* of *Silver*, 17 pound; and because one hath not other *lead* than what the centner contains in 2 *lots* of *Silver*,  
 then



then there will come upon the 9 *lots* of *silver*, in the copper, and of the *silver* in the *lead* to one piece, 2 *centners* and 1 pound of the two *lots* of *lead*: but to a fresh piece you must not take all such weak *lead*, or which doth contain *silver*, but mingle it with the fresh *lead* that the *silver* may come out cleaner, yet for want of fresh *lead*, sometimes such weak *lead* is taken as necessity requires.

CHAP.  
XXVII.

Upon the common melting Furnaces, the Additions are made in stead of the fresh *lead*: with hard *lead* or *Litarge*, and substract the waste, what might go off in the *fresh*, and in stead of the 100 pound *fresh lead* you must take 125 pound *hard lead* and *Litarge*; yet the *Litarge* and *hard lead* must be refreshed with *fresh lead*, else, at the last when the *hard lead* is too weak, there will be damage: This may be used also in this labour and melting, if one have *Litarge* and *hard lead* that (according as above is mentioned) to add to the 2 *centners* of *roast* the competent weight of *hard lead* and *Litarge*, and let it go through the *Oven*, and then the *fresh* pieces are cast right.

5.  
Hard oar  
and Litarge

But possibly some person may say, It could not well be done for the *spar-stones* sake; yet it must again be considered, Though the *spar-stones* may be *leady* yet they will be very poor in *silver*, and therefore they are not spoiled, though they be *leady* and mingled with them, and so bring them among the *Copper-stones*, in the *roasts*, which will afford but little profit, therefore 'twill be more profitable to melt them.

6.  
Spar-stones.

Further observe, If one would melt the stone, and beat the *hard lead* and *Litarge*, care must be taken that one doth put in the *hard lead* and *Litarge* when the stone is in the *Oven*; and then the *lead* needs not stand so long on the *hart* among the *copper* and *slacks*, and thereby burn: but it were better to refresh the *Litarge* and *hard lead* fully (after the *Goslarish* manner) whereby you

7.

C c c c

may

CHAP. may make (with one labour in one day and night) 100  
 XXVII. Centner of fresh lead which else is lost, but when the Ad-  
 ditions are to be made with it after it hath been refresh'd,  
 then there goes nothing more off in the little by-Oven,  
 only that it will flow and work through amongst the  
 Copper, and such refreshing of the *hard lead* and *Litarge*  
 may be done (if one thinks it not too great a labour)  
 that the work might go the better.

Section.  
8.

How to  
make the  
Oven and  
cast the  
fresh pieces.

When the *Melter* thinks fit to shut the *Melt-Oven*,  
 then he must make the *Crucible* in the *barth* a little nar-  
 row and deep like a *fresh Oven*, and near that *Oven* an-  
 other little *Oven*, in which the wind may drive, and wher-  
 in he may also warm the added *lead*; and when he begins  
 to set it, and hath two *centners* of the weighed *roast* upon  
 the *Oven*, then he must put in some weak *slacks*, by  
 which he may see when the two *centners* of *roast* are  
 thoroughly done when those *slacks* do come, then he stops  
 the hole of the *Oven*, and draweth off the *slacks* and *stones*  
 from the *Copper*: and then take out of the by-Oven  
 the hot *lead*, and the *Copper* in the *crucible*, with a  
 warm *ladle* to reach into the *crucible*, and take out a  
 ladleful or two, that it may come among one another,  
 and then he must cast into the pan the first fresh pieces,  
 and when it is cast then weigh it, by which you may  
 easily see whether the desired *copper* be come: and  
 when the first two *centners* of the *roast* are melted  
 thoroughly, and the weak *slacks* do come and the *Eye* or  
 hole of the *Oven* is stopp'd, then the *Melter* must set  
 up another *heap* of two *centners* of the weighed *roast*,  
 but whilst he casts the *fresh pieces*, the *Melter* must take  
 out again the gathered *Copper* which flows out upon  
 the *barth*, and warm another weight of *lead* in the little  
*by-Oven*, that the work may go speedily on, and not be  
 hindered.

9 When these two *centners* of *roast* are set in the second  
 time

time, then the *Melter* must put in again some of the weak *slacks*, and when they come, then he must stop it (as before) and draw off the *slacks*, and must take the *lead* out of the little *by-oven*, and cast the *fresh piece*, thus he may melt continually as long as he hath *Copper-stone* to put in. CHAP. XXVII.

Such fresh pieces when there are enough, cast into the melting-*oven*, and they are to be melted off, while other *fresh pieces* are melting and making. 10.

This melting-work is (in my judgment upon such *Copper-stones* which yield *copper*) very profitable in comparison to the other: because you have the *Silver* quickly out of the *copper*, with the same *Expence* as is spent upon the *black Copper* making, and used with profit, better than when they must first be melted in the *copper*, and afterwards with great *Expence* to be wrought, and the *Silver* to be assayed out of it. Upon which every one who useth to melt may further consider. 11.  
The profit  
of this Assay  
work.

This also I think fit to mention for the Instruction of the common *copper-Melters*, so that all who care for it may be diligent in it: for this is not only a supposition, but proved in the great work. 12.

What and how the *Thornels* (and other things which come by melting) may be melted and made to profit (as before is shewn:) the form of the Melting-*oven* and of the little *by-ovens* will be seen in the *Sculpture* following, which is thus 13.

Deciphered.

1. *The Fresh Oven.*
2. *The little By-Oven for lead.*
3. *The fresh piece, with a man lifting it.*
4. *The Separation of roasted and weighed lead, brought by a man in a Wheel-barrow and laid in heaps:*
5. *The*

- CHAP. 5. *The Vault for the Smoak and Dust.*  
 XXVII. 6. *The Tunnels to convey away the Smoak.*  
 7. *The fresh Oven without fire in the Furnace, or fore-wall.*  
 8. *The Assay-Oven. 8. 8.*  
 9. *The little Pans for the melted Metal.*

Sculpture XXXIV.



## CHAP. XXVII.

How Copper is to be made Brass.



O the *Brass* burning as it is observed in *Cauffingen* in *Hessen*, and as before in the City of *Goslar* and in *Ilfenberg* on the *Haiç*, they use *Goslarish Lapis Calaminaris* which is sometimes gathered out of the *Smelt-Ovens*, where (in smelting the *lead Oars* into 10 or 12 pieces) it oftentimes lyes about a hand thick; but the *Lapis Calaminaris* at *Galmay* mountains, and other mountainous places, (as those near the River *Ach* in *Schwaben* or *Swevia*, in the County of *Tyrol* in *Austria*, and elsewhere) breaketh yellow and gray, and is to be added to the *Copper* to make them of a *yellow Colour*, and which is called *Brass*, but the *Goslarish Lapis Calaminaris* must be roasted or burnt and ground small upon a *Mullet* made on purpose, and then they prepare it as followveth.

They take one part of it, and two parts of small ground *Coal* well quench'd, and well mingled; dry them with one another, then pour a bowl-full of water upon the *Lapis Calaminaris* that it may every where suck it in, let it stand an hour and moisten together, but some use *Urine* instead of *water*, and add a little *Allum*; this gives the *brass* a fair colour in the first fire: then they have a crooked Instrument and draw all well together 3 or 4 times, then mingle it with a proportion of *Salt*, and draw it again with the Instrument twice or thrice, thus the *Lapis Calaminaris* is prepared: but they make alwayes so much *Calaminaris* together at once, as will be needful for two Ovens.

D d d d

When

Section:  
I.  
Copper dif-  
ferent in  
Countrys.

2.  
To prepare  
Lapis Cala-  
minaris.

CHAP. XXVIII. When they make *Brass* they make round *Ovens* in the ground, so that the wind may force the fire through the holes below in the *Oven*, and in one of these *Ovens* they set 8 pots or pipkins at once, and let them be warm and hot, and when they are so, take them out quickly, and put the *Calaminaris* in them, also they have a shovel made on purpose, that therewith they may take up and know how to distribute near 46 pounds in such eight pots. Then they lay in every pot upon the *Lapis Calaminaris* 8 pounds of small broken Copper pieces, and set in the pots again, and let them stand 9 hours in a great heat, and in this 9 hours are to be taken one heap and a half of Coals, and when such Coals are burnt out, then stir the stuff in the pot with an iron, and see how 'tis flow'n, and let it stand in the *stuffs*, and *graduation* an hour more, then lift the pots out of the *Oven*, and pour them (if you will have a piece of *Brass*) all in one hole, and while the stuff is warm, break them, yet so that they may remain and lye close together.

4.  
Brittain  
stones.

Thus the *Brass* receives in the *breaking* a fair yellow colour, but if you make *Kettles* of it, and other work, then cast the *stone* into great pots and large pieces purposely for it, which *stones* are called *Britanish Stones*, or *Lapis Calaminaris*, (because they come thence) from which they cut afterwards some *Ingots*; and from them draw *myers*, and beat out what they please for other uses.

5. Sometimes the *Brass-burner* sets in the *Brass* once more, especially if they will have the colour higher, but 'tis not with profit to be done, for the expence is more than the gain.

6.  
The Proportion of Copper and Lapis Calaminaris.

Further, 'tis to be known, That the *Brass* receives in such burning a *heaviness*, for if you put in these eight pots 46 pounds of *Copper*, so the *Brass* will receive in 9 hours an increase of 26 pounds of *Brass*, so one pour-eth out again 90 pounds of *Brass*, this comes from one

Oven

Oven in the week, as to 14 fires) to 3 Centners 34 CHAP. XXVIII.  
pounds of Brass increase: And others say, That the Goslarish Calaminaris brings more increase than the mountainous Calaminaris, but it makes the Brass in the breaking gray, therefore in the glowing you must take care, that the stuff may not run in the work; and it must only be made glowing with the flames of wood.

This I was willing to mention in short, how Copper is to be burnt to Brass, for their sakes who know nothing of it: But how the Kettles are to be beaten, and the wyer to be drawn and extended by water, is to be seen at Ilsenberg, in their works, and in many other places. Section.  
7.

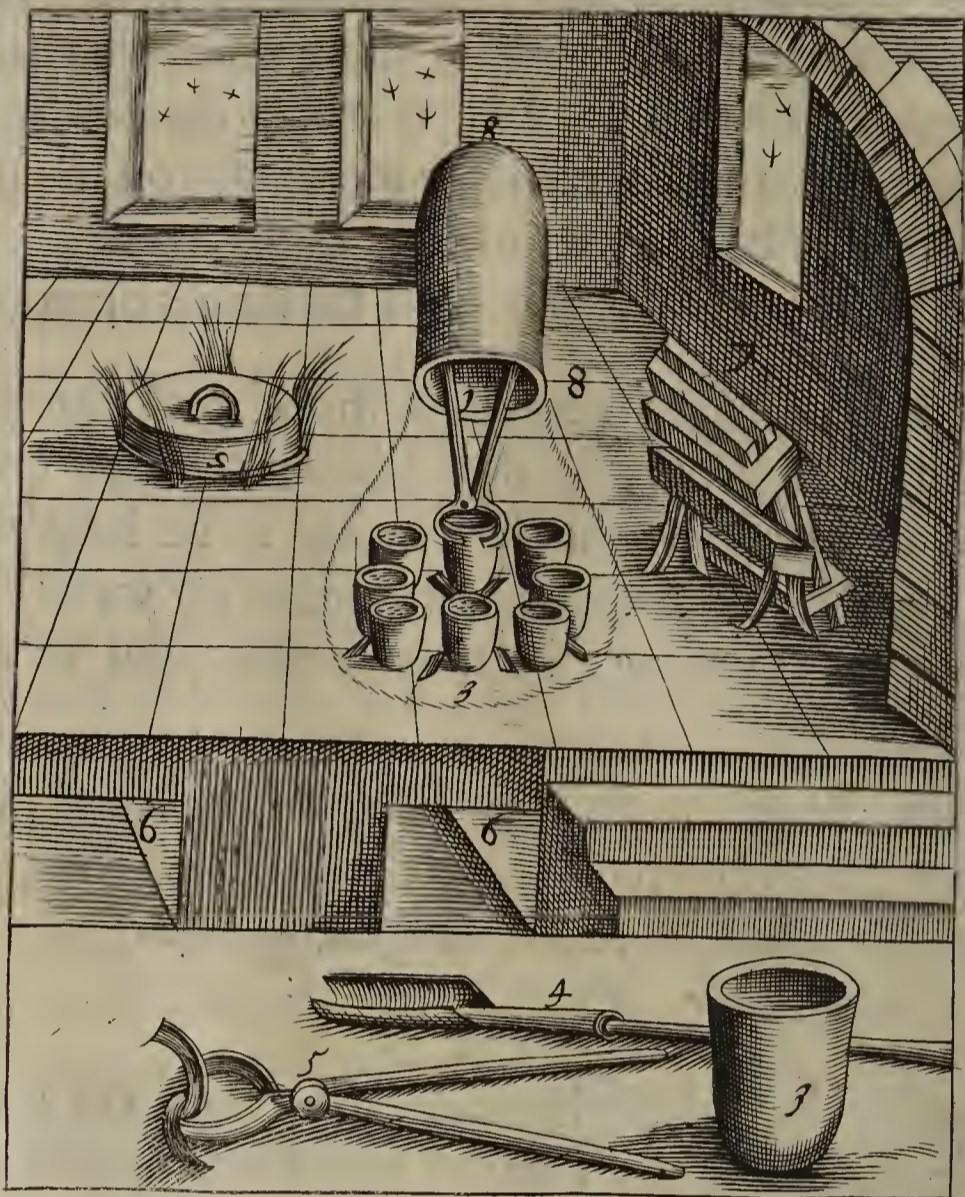
How the Brass Ovens, the Pots, Shovels and lifting Tongs are to be framed, and the British stone disposed of, the Sculpture following shews, thus 8.

Deciphered.

1. The Oven in which Brass is to be burnt: the shape of it in the inside, and how the pots and crucibles are to be placed in it.
2. The little brass Ovens are to be placed in the other.
3. How the Pots and crucibles are to be formed.
4. The shovel to take up the beaten Lapis Calaminaris stone, which is to be mixt with Copper for the making of Brass.
5. The tongs by which the Pots are to be set in, and taken out.
6. The holes in the Oven.
7. The pieces of the British stone or Lapis Calaminaris unbeaten.
8. The place for the workman that sets in the Pots.

Sculpture.

Sculpture XXXV.



Thus I conclude the *Third BOOK* concerning *Copper Oars*, and its *Labour*, with other necessary *Instructi- ons* appertaining to it; and the *Reader* may consider further upon them: as also of other things which he may have occasion to use.

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*The END of the Third Book.*

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OF

# Lead OARS, TIN,

ANTIMONY, QUICKSILVER, IRON,  
STEEL, and the LOADSTONE.

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B O O K IV.

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CHAP. I.

*Of Lead Oars.*



**H**IS Book shews how to prove *Lead* Oar for *Lead*, and how the common or unseparable light *Lead Oars* are to be smelted in the great smelting Work: next, how to prove an Oar for *Antimony* and for *Spelter*, and how to bring the *Spelter* out again: Also to try *Tin-stones* for *Tin*, and *Quick silver Oar* for *Quick silver*: Also of *Iron stone* and *Steel stone*, for *Iron* and *Steel*, with some Instruments for *Tin sope works*, and trying of *Tin stone* in the little *Oven*: and also of the wonderful properties of the *Magnet* or *Loadstone*.

Now, concerning *Lead oars* they are usually to be well known among the other *Metal oars*, for they are mostly grey, heavy, bright of colour like the *Lead* it self, and from its brightness is called *bright oar*; and such bright colored *Lead oars* are the richest, and contain above half lead: then there is *white lead oar* like a *Sand-stone* and *red lead*

Section:  
1.  
*The Purpose  
of this Book.*

2.  
*Lead known  
from other  
Metals.*

3.  
*Bright Oar.*

4.  
*White lead  
Oar.*

5.  
*Red Lead  
Oar.*

E e e e

*oar,*

CHAP. *oar*, like a reddish clay, these Two, *viz.* the *white* and  
 II. *red* are heavy, but not so rich in *lead* as the bright: also  
 Section. *yellow lead oar* mixt with *grey*, which is called, the *Lead*  
 6. *ram*: These and such like *Oars* are counted the smooth-  
 Yellow lead Oar. flowing and *deft oars*: and the heavier they are, the more  
 they yield in *lead*.

7. But the *lead oars* which are poor, and taken from *flinty*,  
 Flinty Lead Oar. *blendy* or *mountainous* places, are either visibly or invisibly  
 insperg'd or sprinkled with brightness (like the *Lead oar*  
 at *Goslar*.) and are very heavy: yet commonly no visible  
 8. brightness in them, they are somewhat hard and unflow-  
 Unseparable lead Oar. ing, yet they do partly separate and purify in beating  
 and washing, but partly they do stick fast in the water,  
 that one with the other remain unseparated.

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## CHAP. II.

*How to prove defty-lead Oars for Lead.*

1.  
The mix-  
tures for it.



PROVING of *Lead oars* do require dif-  
 ferent observations (as in other *oars*,  
 therefore the *pure-soft* and *flowing-lead*  
*oars*, you must prove thus, first grind  
 the *oar* small, and weigh of it two *cent-*  
*ners*, and put it in a *crucible*, with twice  
 so much *flus* which is made of *Copper oars*) with a lit-  
 tle *Sandiver*, and mingle it with a little *filed Iron*, after  
 this put also on the top of the *Crucible* a half square fin-  
 ger high of common *Salt*, press it down a little and co-  
 ver the *Crucible*, and lute the joynings with a thin  
 Clay, that no coals fall into the *crucible*, for that will  
 do hurt, especially in the *Lead-Proof*, by reason the *flus*  
 will boil up in the *Crucible*, and the *lead* will not come to-  
 gether in one *grain*, but in the *stacks*, like *grains*.

When

When your *Crucibles* is thus prepared with the proof, then set it in a *little Oven*, prepared for the proof of the *Copper Oars*, put fire in it, and when the *Crucible* is glowing, blow very hard with a hand-*Bellows*, that the proof may have a strong heat, so that it need not stand long: then take out the *Crucible*, and let it be cold, then beat it aunder, and you will find below a *grain of Lead*, so much as the 2 *centner-proof-weights* will yield; then draw up the *Proof-weights*, and you will see how many *centners* of the *bright or deſt-lead Oar* will yield a *centner* of *lead*.

But to this proof must be added *filed Iron*, that the *Antimony* which is in the raw *lead-Oar* may touch the *Iron* rather than the *lead*, for if it had no *Iron* to consume, it would begin on the *weak Lead*, therefore in many places, in the great fire, *old Iron*, or *Iron scales, ſlacks* and *ſinders* are to be added to the melting, whereby more *Lead* is produced: it hath alſo this ſervice in melting, that ſome *Lead* yields foul and unclean vwork, which by the Addition of the *Iron* becomes clean, for the *Antimony* or remaining *Sulphur* vwill give it ſelf (in the melting in the *Lead-Kilns*) to the *Iron*, and will come away that ſo the *lead* may be pure.

But ſome *Assayers* pretend to ſet the *Grain-lead* upon a *Teſt*, which in proving is found below in the *crucible*, and let it drive, ſo it vwill become clean: which is falſe, for the *Lead* being a *vweak-volatile Metal*, eaſily consumes it ſelf in the fire: therefore I judge that vwhen the proof hath once ſuffered the fire, the *Lead* vwill become good and clean, unleſs the *grain* of the *Proof* be not clean, and that there doth hang on the ſame *Lead*, raw glimmer or ſtone, which is a ſign that the *Proof* hath not received its due heat, which ought to be obſerv'd by the *Assayer*) and then he muſt make the proof once more.

CHAP.

II.

Section.

2.  
How to diſ-  
poſe it into  
Crucibles  
and Ovens.3.  
Iron is to be  
added to the  
melting of  
lead.

4.

CHAP.

CHAP.  
III. IV

## CHAP. III.

How to prove an undefty, Lead-Oar for Lead.



UT the right lead Oars (which have with them some flint, or other harsh stuff) they prove thus: Beat the *lead Oar* into pieces, as small as grains of *bemp*, and weigh of them 2 *centners*, and set them in an *Assay test* in a proof *Oven*, and roast them, but make it not too hot at first, that it may not run together like *Sinders* (and do just as is above mentioned with the *Copper-proof*) then grind the *roast-Oar* very small, mingle it with the *flufs* (covered with *salt*) and you need no *filed Iron* to this, for it hath two *contrary Sulphurs* which consume one another, so that the *lead* will remain sure, then boyl the proof in the little *oven* before the *bellows* (as before) thus the *lead* will be right in the proof.

## CHAP. IV.

How to prove poor separable Oar by boyling it, and trying it by smelting.



1.  
A good way  
of beating  
Oar.

ANY times also *Silver* containing *Lead glimmer* do break in the *Oven* (being insperged with *stony-Oar*) but when you have a separable Oar, let it separate it self from the glimmer in the water, *viz.* when the *Oars* are beaten that they may be drawn in washing and cleansing to a pure Oar: of these

I must mention something for the good of the *Mine-Workers*, what difference is to be observed in the *beating*, because oftentimes by Negligence comes damage; but first of the *try-proof* in the little work.

CHAP.  
IV.

Take a common proof of the *light oars*, beat it small and mingle it well, weigh of it by the Proof-weight 20 *centners*, more or less, and draw it into a Tub to a clean Oar, and gently separate this from the *light*, and weigh how many *centners* of clean oar, the *wash'd common oar* will yield; and then you may easily reckon how many *centners* of *common oar* will yield a *centner* of *good oar*; and this pure *oar* may come to be so by the beating, sifting or washing it, (and do waste and prove, as above) but the good clean and bright *oar* is proved upon *lead*; thus you have the *content* of the *Lead*.

Section.  
2.

Now concerning the *beating* in the *great work*, the *lead oar* you know is a heavy Oar, yet 'tis subtile and easy to be beaten into *dust*, which swims upon the water, and goeth forth; especially, if the same be in a *glimmery* or *flinty*, or *horny stone* (which *Quarryes* or *hornstones* do afford) to which add the *glimmer* in beating, and make it dust, and this *subtile dust* (which is the best of the *oar*) doth oft times yield a *blew, dust* which will lay it self on the great walls or stones in the washing, and comes to no profit.

3.

But, some use the *Beaters* or *Workers* (which build the *Beat-works*) to prepare thus the wet-works, *viz.* That the hindmost *stamping Pestel* which beates the light or rocky Oar from behind, and beats against the *lamins* or *plates*; understand it in this manner, That the *hindmost Pestel* may fall first, then the middle one, and at last, the first next the *Plates*.

4  
A hurtful  
Beating.

This beating is not profitable because it causeth great damage, by reason that the beaten stuff or rocky *oars* set themselves before the *Plates*, so that the *graind oar*

F f f f

cannot

CHAP. V. cannot well come through, but beats it self into a small or subtil *dust*, and goes away in the beaten or wash'd stuff, therefore many *Washers* esteem the *dry-beat Works* better, where one may work over the *Seeve*, and have the great and small *Oars* asunder, and also make more sorts than with the *wet work*, which is found that if the *wet-beaten work* is built and prepared thus, the poor or *rocky Oars* will be beaten back from the *plates*, viz. that the *Pestle* nearest the *plates* will fall first, then the middle one, and at last, that which is behind, thereby the *plates* will remain *clear*, and the holes will not be stop'd, but the water will carry the pure *Oar* through without hindrance, whereby not only more *Oar* will be preserv'd, but also the *Oar* may be made great or small, and so to greater profit: and having found this in the work, I would not leave it unmentioned being so fit for every *Mine-worker* and *Assayer* to know.

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CHAP. V.

*How to try common Lead-Oars for Lead, in a little Oven.*



LIKE as the *Copper Oars* (mentioned in the *Third Book*) are to be try'd in a little *Oven*, so may it be done with the *Lead Oars*, especially if they are very clean, right and good, let them be thus beaten raw, as small as half an *Hazel nut*, then set them upon a little *Oven*, but it were better 3 or 4 pounds of such small beaten *oar* might be laid first upon a *Test*, and gently roasted, and then beaten and roasted again, that its great *wildness* may come off, and so the *lead* will easily separate from the *slacks* without other *Additions*.

CHAP.

## CHAP. VI.

How the inseparable and light Lead Oars are to be assayed in a little Oven.

Section  
1.

CONCERNING the light-common-  
Lead-Oars, which do not separate in  
the water, they must be beaten in like  
manner as is spoken of the *separable*; on-  
ly they must be roasted somewhat better,  
and when they are thus prepared, then  
melt them through the little *Oven*, but when the *lead* is In the little  
Oven  
not come altogether, then beat the *slacks* very small again,  
and take the clean *lead* from it, as you separate the *stone*;  
Now when the *Lead oar* is *flinty* (if one be diligent)  
then weigh the *lead* which is cleanly separated, and make  
your account how many *centners* of *Oar* may yield a  
*centner* of *Lead*; but if the *lead oar* be very *coppery*, 'tis  
to be roasted, whereby in the proof melting the *Copper*  
will come among the *lead*, therefore it must be separated  
upon a very flat harth, and you must cause the *lead* (as  
above in the *Copper* proof direction) to run off with a  
gentle fire, and so the *lead* will become clean, and the  
*Copper* will remain settled, and this makes clean work (as  
you are taught before.) But the little *oven* for proving  
the *lead oars* must be prepared (like to the *Copper Oars*  
and *flints*) that you may bring out the *slacks* and *lead*  
very clean, as such practise will shew.

But in the *Assay Crucibles* the proof must be thus: In Crucibles  
Take the light *lead oar*, grind it small, weigh two *Cent-*  
*ners* of it with thy *Proof-weight*, set it upon a *proof Test*  
in the *Oven*, let it roast till it stink no more of *Sulphur*,  
then grind it small, put it in a little *Crucible* with four  
*Cent-*

CHAP. VII. *centners* of the *fluss* (which is used to the *deft lead Oar*) put in it also melted *Sandiver*, and cover it with *Salt*, lute it with *clay*, and let it boyl in the little *Oven* before the *Bellows*, blow more strongly to this proof than to the clean bright proof, and thus you have the *Content* right.

<sup>3.</sup>  
Unroasted. You must also know, That every *lead Oar* may be proved unroasted; thus, Grind it small, weigh two *centners*, use the *fluss* to it (according to Instruction given) only with the *Sandiver* take among it raw *Argol*, mingle it together, cover it with *Salt*, and the *crucible* with a covering: Lute the joynings with clay, and set it in one of the little *Ovens*, blow strong to it like to a *Copper proof* (as above) thus you will find the *Content* of the *Lead*.

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CHAP. VII.

*How to make a Lead-Proof on a Table or in a Stove.*



THE *Lead oar* to this proof must be very clean and good, take and roast it a little, then make a *fluss* of two parts of good clean *Salt-Petre*, and one part of small ground *Coals* mingled together, put two parts of this *fluss*, and one part of the roast *Lead oar* also well mingled into a *Crucible*, cast a little glowing coal in it, then it will begin to burn, and the *Lead* which is in it will flow together, and although this is an uncertain proof (not to be trusted to) yet thereby one may learn to know the property and nature of *Minerals*.

CHAP.



CHAP. VIII.

How to make Lead Oars (though they will not separate in the water) to be profitable.



ALTHOUGH I intend not to write much of the smelting, and thus to mingle what pertains to the smelting and lesser proving; yet I could not but leave somewhat to signify of *smelting* of the *light lead oars*, because 'tis necessary, and no common labour, but to many unknown.

Section.

1.

Rocky lead Oar.

The *Lead-oars* which are poor, and will not separate in the Water, are *flinty Glimmer*, or such as come from *unseparable Oars*, and yet to be made to profit (if one have a pretty quantity of them) but not by the common *smelt-work* or *arch'd oven*, for there the wild and *sulphury slacks* of the *oars* consume the *Lead* very easily, that almost no *Lead*, or not half so much as in the little proof is found or can be made, but only after the useful melting at *Goslar*, with which the light contenty *lead Oars* of the same place are to be smelted in a great quantity, and by no other ways, as by me and many others have been tryed.

2.  
The Sulpher Slaks, devour the Lead.

But that you may have a sure Instruction for this work, and how such *volatile oars* may be help'd, I shall therefore describe the whole *Goslarish Method*, which they use in preparing their *Ovens*, &c.

First, I will signify what manner of *Lead-Ovens* there are at *Goslar*, and what they contain, that one may the better find out what doth follow.

The *Lead Oars* at *Goslar* are commonly *black Oars*, also a *white-gray flint* with *insperged Copper flint*, and

3.  
*Goslarish Lead Oar.*

G g g g are

CHAP. VIII. are very shining, which Glimmer is not to be seen in the Oar, but apparently in the melting and slacks, a Centner of the best of that Goslarish oar (if there appear not Glimmer) doth not contain above 16 pounds of Lead, but of the common Oar (mingled among the flint which cannot be separated from it, and breaketh the most) usually there is but 7 pound of Lead, and of the lightest less: this also hath an Oar Quarry which stands intermixt with it, and this Oar is to be roasted in very great Ovens, and to every one three fires given; and then a Centner will contain but little above 5 pound of Lead, and one dram of Silver (notwithstanding it contains more before the roasting) which I judg doth come of this, that in the roasting such Oars there comes among the others, light and good; and therefore the Content is more equal, and these 5 pounds of Lead, and one dram of Silver are for the most part melted out in the Smelting.

<sup>4.</sup>  
Two melt  
Ovens upon  
one water.

Secondly, In the same place must be no more than two Smelt Ovens to one spring (though the Melters think (if it might be so for the Waterfalls-sake) that it were better that every Smelt oven should have his own spring and wheel, because every one might order his Bel-lows most advantagiously, which must be with great might and with heaps (as will be shewn) to force the Oar through the oven: yet it is at all times set through the smelt oven nearer the Wheel, than through the other, and so where is more set, there is more Lead made, and with more profit of the Coals.

<sup>5.</sup>  
Smelt  
Ovens.

They make such Smelt ovens inward, within a wall of two bricks and a half deep, and two bricks wide, and the Walls above it, two ells and a half high, of Shiffer-stones which are not thick, that one may, when he will, break out the Oven for the Lapis calaminaris, which grows in it (as hereafter you may hear) for the Shiffer  
or

or *slackstone* in the same place will very well indure the fire, and they do lay the foundation of the same two ells deep under it, crossways; that it may go out against the bellows; yet some foundations extend or reach to the *wheel-room*, but I do not approve of it, for if they become moist thereby, or draw moistness to it self, then it is hurt in melting, therefore it matters not a little that the *smelt Ovens* be right in their wideness and hight, as also that the Foundations be in their right places, that no water may come in, not too deep nor too moist, for if the water go on the Foundations, then the *stuff* in the *Lead* will not separate nor work well; also that the forms may lay right according to every kind and condition of the *Oar*, neither too sharp nor too flat, which should be fitted that the Bellows may blow in the midst of the *stuff* in the *oven*, just near the forewall; The *smelt Ovens* at *Goslar* have very great Bellows, of six ox hides to one pair, to force the *Oar* through in great quantities, therefore the Bellows must be strong.

Concerning the *Crucible* in the *oven*, it must be made thus, Lay upon the Foundation a great stone, which is called the *Crucible-stone*, upon this they make a harth of *Clay*, mingled with little *slacks*, and upon it, another harth of *Clay*, and when 'tis dry they wash the *Crucible* which is half in the *Oven*, and half out, the middle standing right under the Wall) with burnt *Oars* of a thumbs thickness, and when 'tis dry and well warm'd, that it will glow very well, and become firm in the *Crucible* like *steel*, then the *smelt oven* is prepared till the closing: but such a *Crucible* must be to the *smelt oven* five quarters of an ell deep, and without the *oven*, it must so bend it self that the *Lead* may come to stand before the *oven* in the *Crucible*, and not in the *oven*.

When all this is done, then they put a vessel with Coals in the warm *Crucible*, and upon the Coals three

Vessels

CHAP.  
VIII.  
Section.

6.  
Two Crucibles for the Lead.

7.  
The Closing the work in the Ovens.

CHAP. Vessels full with light *coal-dust*, which they make thus:  
 VIII. They make on the Wheel on the end of it a *Beater* or *Mallet*, and as the wheel goes round about, then the *Mallet* falls down twice upon little hard coals, which the servant of the *Melter*, when he hath time doth put under with a *Shovel*, albeit it is a slow work, yet they make so much *dust* with it as may serve two *ovens*, for they are not willing to lay so great a burden upon the *Wheel*, but they beat no *Clay* with it (as they use in the *dust* in other *Smeltings*) then they moisten their *Coal-dust*, and force and beat them with some heavy thing, into the *Crucible* in the *oven*, (commonly with an *iron Beetle*) that it may not come upon one another, and also before the *oven*, vvhhere they make it a little higher, that the *slacks* may not flow out, and leave a hole open below on the *oven*, under the *forewall*, (which is called an *Eye*) that one may almost reach his hand into the *Oven*.

8.  
 Of kindling  
 the Fire.

After the preparation and *closing* of the *oven*, they put on the *Top* of it *glowing* and other *Coals*, and after that a dray or two full of their *slacks*, then *coals* again, upon it the burnt *oar*, and so continually *coals* and *oars* till the *Oven* be full to the top, also they lay before it *live coals*, but not many, only that the *dust* may remain *warm* near the fore-vvall, vvhhere the *slacks* flow out: Now vvhhen the *oven* is set full, they stay till the fire burn in the *Oven*, and then they begin to melt, and make the *Oven* vvet, vvvith vveak *slacks*, as in other *meltings*: neither have they *Iron-stones*, but *copper* which is to lye pretty far in the *oven*, for the *Iron gratty slacks* vvvill devour the *Iron stones* quite in twice vvvorking, which they do not so easily to the *Copper*: yet in time they do consume also, so that they must be renewed once in a quarter of a year.

Their time to melt is 23 hours, in this they set into  
 one *Oven* 66 to 70 *Centner* of roast *oar*, and the *oar* vvvill  
 flow

flow like water, and vvorks it self very fresh, and there is nothing else to be taken to it, but only the burnt Oar. CHAP. VIII.

Now, when the Melter lifts off the uppermost *slacks*, (which is very heavy and thick) the rest under it will stand very clear, and then with a great *iron Ladle* he pours them out, which will run like *lead*, so fresh as they are, and the *slacks* look like a melted *slack-stone*. But the *lead* creeps through the light *dust* in the Oven, and hides it self under it near 23 hours, and therefore the wild *Sulphurish slacks* cannot reach it, nor the long during heat consume or devour it. Section. 9.

When the Melter hath observ'd his time, then he opens the *Funnel* below, and takes out the light *dust* together with the *slacks* which are settled in it, and whilst the Melter is drawing the *dust* out of the Oven, a servant must gently pour water, that the Melter may endure the heat, and when all the *dust* is drawn out, then the Melter with his fork stirs the *Lead* in the Oven below, so that all the *Lead* may come together, then he casts the *Lead* into the *harth* standing by the Oven, and it must be kept warm continually. 10. Opening the Oven.

Out of this he draws it into *Cakes* or *sows* of *Lead* (according to the old *Fryberish* Method, and brings out of the 60 or 70 *Centner* of melted *Oar* (in such a time well melted) near three *centner* of *Lead*, of which one *centner* contains 4 *lotbs* of *Silver*, and the rest of the *Lead* and *Silver* will remain in the *slacks*; and though there be almost as much yet remaining, it is a Wonder that so much should be produced out of a poor *contenty stubborn Oar*. 11. Of the Cakes or Sows of Lead.

But if you would melt other *Oars* besides this (after the *Goslarish* Method) you must be careful the *Oar* may vvork it self fresh; for if it do not, then you must help it, for the light *dust* cannot suffer the very *soft slacks*, also 12.

H h h h

when

CHAP. VIII. when the *light lead Oar* contains pretty much *Silver* and little *Lead*, then at all times, according to the condition of the *Oars*, there may be added hard *Lead*, that the *Silver* may have a refuge into the *lead*.

Section.

<sup>13.</sup>  
Galmy, or  
Lapis Cal-  
minaris.

I must signify, that in the *melt Oven* of the *Goslarish Lead oars*, they lay on all four walls of the *Oven* a *gray* with a *yellow mingled matter*, every *Row* or *Lay* as thick as a *straw bredth*) which they call *Galmy*, used in the *brass-melting* (and adding as you have heard in the end of the *Third Book*;) and this matter must be put out of the *melt Oven* after 8 or 9 *Rows* or *Lays* are made, else the *Oven* will be too narrow, so that no more can be melted in it with profit.

<sup>14.</sup>

The Goslar  
Mine 700  
years conti-  
nuance.

Thus much I was willing to mention of *Lead oar* and *Lead*, that every *Mine* and *Smelter*, who will imploy himself in it, may know how every one may be help'd; for 'tis a weak *tender Metal*, and may in *Smelting* quickly be hurt: And, 'tis manifest, if this way of *Smelting* of *poor light oars* of *Goslar* had not been invented (by which they make their *Lead*) neither the *City*, nor the *Mine-work* could have been thus long useful, having continued these 700 years, and by the help of the *Lord* may longer continue. The following *Sculpture*

Deciphered.

1. The Walls of the Furnace.
2. The Lines on them, shews the Gradations of the Metal descending.
3. The man that manageth the metal in the furnace.
4. The back of the Furnace with the coals and pieces of metal flaming.
5. The grand Test.
6. The Oven for that Test.
7. The pieces from the Test.
8. The man that beats the Oar.

9. The

9. *The pieces of Oar and Cinders;*
10. *A heap of Charcoal.*
11. *The water-troughs to wash the Oar in.*
12. *The Pipes by which the foul water is cast out.*
13. *The Instruments for the Furnaces and Tests.*

Sculpture XXXVI.



## CHAP. IX.

Of melting Oars with Moll or Turf.



The proper-  
ty of the  
Molls.

BECAUSE some years since the *Miners* and *Smelters* have pretended that all sorts of *Oars* might be melted with *Sods* or *Turff* (as the *Saxons* call it) I could not omit in this part, but give the *Reader* my Judgment. And because the *Oars* are not all of one sort, but partly harsh and hardy, and partly mild soft and flowing, and that the *Turf* yields very heavy and much *Ashes*, which in the *Melt oven* comes to be a *slack* (almost like a *Glass*) I judge it must not be used at all to the weak *oars*, to which this separating *Work* is unprofitable, for through their many heavy *Ashes* the weak flowing *oars* are hindered, and the *Oven* thereby stopped, and though you use half coals with it, yet it would not turn to profit. But what are *harsh-hot-graty Oars* (especially *roasted lead oars* by help of *Coals*) may be melted, and it will be serviceable, for they will work themselves more separable and dest: so that one need not much other addition (as aforesaid.)

But if one would melt such *harsh Oars* with *Turf* only, I fear the *Oven* will be stopped many times, by which the work will be much hindered; therefore I conclude it better to melt with *Coals*, than with *Moll*, *Sod* or *Turf*.



## CHAP. X.

How to prove Spelter or Wizmet Oar, which some call Bizmuth.



SPELTER Oar is a white heavy Oar, and yields among other Oars the most flowing Metal, which needs no singular Pains to melt it down: But there are two sorts of melting it, in the *Wind*, and before the *Bellows*; as will follow: for, if you

Section.  
1.

Two sorts of  
Spelter Mel-  
ting.

will prove this Oar, how much Spelter it may contain, then grind it small, and weigh a centner of it, and two centners of the *flus* (before spoken of, made of *Argol* and *Salt peter*) mingle it, and put it in a *Crucible*, covered wit *Salt*, and cover it, Lute it with *Clay*, and boyl it up in a little *Oven* before the *bellows*, like (to a flowing *Lead proof*) thus you will have the *Spelter* below in the *Crucible* like a *lead Regulus*; draw it up after thy proof weight, and you will find how much Spelter a centner of Oar yields: but, till of late, we had not the vway to melt so much out of the Oar, as hath been found in the proof, and the difference is alike, for we finde almost the half part more in the little proof, vwhen the Spelter is melted out of it: But, as it hath been mentioned in the *Tin-slacks* (vvhich by a strong fire vwill melt the remaining *Tin*) so it is possible to do vwith the Spelter.

2.  
The Differ-  
ence of the  
Content.

But to melt the Spelter out of the Oars tyvo methods are used: one by the *wind*, the other by *Bellows*: the vveakest sort of Spelter Oars are to be melted on the *wind*, vvhich is to be done thus; Take of the Oar, and Beat it to little pieces, about the bigness of *Walnuts*, and put it in little *iron Pans* (set in order) that they may

3.  
To melt on  
the wind.

CHAP. spread abroad, and set them in the field in the winde, and  
 X. make a fire of dry wood, so that the wind may bring  
 the *flame* into the *pans* upon the *Oar*; thus the *Spelter*  
 will flow quickly out of the *Oar* into the *pans*, and when  
 'tis almost flown out, stir the *Oar* about, that what the  
*flame* hath not touch'd yet, may be melted all out.

Section.  
4.

This is the true proof for the *Spelter oar* (and the  
 right melting) because after this, can nothing more be  
 melted out of it; then lift the *pans* off the fire, and put  
 out the *oar*, and make the *spelter* clean, let it be cold,  
 and put fresh *oar* into the *pans*, and melt continually;  
 this *spelter* so melted is the best and cleanest, and some  
*centners* may be made at a melting, which melting is  
 clearly to be seen in the following *Sculpture*.

5.  
To melt in  
the Oven.

The other way of Melting it, is thus, make the *Oar*  
 clean and beat it small, and prepare a little Oven, a good  
*span* wide below, and four *spans* high, and above two  
*spans* square, then place a weak *Bellows* (like a little  
*Smiths Bellows*) behind, and in this melt the *spelter*  
*Oars* or *slicks* with wood and soft *Coals*; and before  
 it be all *slacks*, draw it out of the Oven into a *trough* of  
 wood, made on purpose, and in this stir the glowing  
*Oar* to and fro, and so the *spelter* will flow together, then  
 separate it and make it clean; what remains at last of the  
 dross (by either way of Melting) makes a blew colour in  
 great quantity, and may be used for *glass* to give it a blew,  
 'tis here and there sold to the *Glass-houses*.

Zevar Co-  
lour.

Sculpture



Deciphered.

1. The little Iron Pans for Spelter or Wismet Oar.
2. The fire of vwood for them.
3. Melted Spelter that is to be made clean in the iron Pan, and the work-man that tends it.
4. He that draw; the Oar out of the Mine.

CHAP.

XI.

XII.

CHAP. XI.

Of Tin.

Section.

I.

Tin-stone or  
Zwitter.

**S**WITTER or *Tin-stone* whereof *Tin* is made, is heavy Oar, yet the *Metal* which it produceth is the *lightest* of all other *Metals*; the *Zwitter* is to be known by its brown colour, which inclines a little to *yellow*, yet the rich *Zwitter*s are black and of fine growth, and so smooth as if they were polished, and very rich in *Tin*, yet sometimes the *Zwitter*s are found in another form like *Iron stone*, or a pointed *woolferan* Oar (which the old *Miners* have not known) therefore 'tis needful to prove the *Zwitter* with diligence whether it be *Tin-stone* or not, and whether it yields much or little, that the *Mine-workers* may the better know what to do.

But the *Tin-stone*, as well in the little proof as in the great work, must not only be burnt, but also purified clean before the melting, otherwise it yields not so much *Tin*, as when cleanly prepared.

Yet, 'tis to be known that every *Tin-Mine-work* hath a singular manner to prepare the *Zwitter* or *Tin-stone*, which is to be admired.

CHAP. XII.

How to prove Tin-stone for Tin.

I.  
The way of  
Proving it.

**A**LTHOUGH the proving of the *Tin-stone* how much properly doth contain a *centner*, be an uncertain proof, yet by it thus much may be learnt, that one may know whether the *Tin-stone* be good or light, likewise what happily

ly may be made of Tin, and to know its true content, and the most common way to be used therein is as hereafter followeth. CHAP.  
XII.

*First*, when you have taken a common proof of the *Zwitter*, or *well-beaten Tin-stone*, then grind it small, and weigh of it vwith thy proof-weight vwhat you think fit, and dravv that which is vveighed off into the *slick* or *dross*, and weigh that too; then set it in an *Assay-oven* upon a *test*, and roast it in a pretty heat, and when it is cold again, grind it, wash that which is light in a wooden *trough*, and weigh the clean *slick* again, and observe how much goes off from the *slick* in the roasting and shifting, and do this two, three or four times, till the stone is very clean, and that nothing more goes off from it; thus 'tis prepared to the proving.

Of this prepared *Tin-stone* weigh two *Centners*, and mingle among it small ground *Pitch*, and take a glowing *hazel* or *Lime tree coal*, or any other that doth not spring or break in the fire, but remains whole, cool it in the sand, and cut in it a *Channel*, and at the further end of the *Chanel*, make a little hole, into which put the mingled *Tin-stone* above, upon the broad place of the *Channels*, and lay upon the same *Coals*, other *Coals*, just as broad as the first, for which you must also have a hole below and above, that the *Bellows* may blow between, and lute the *Coals* on both sides, that they may remain together; and when 'tis thus prepared, lay it together with a cool temperate fire, so that the *Tin-stone* may come above and in the little hole (in which the Tin is to flow) lay glowing coals upon it, and blow it with the *Bellows*, so that the blowing may just move upon the coals in which the *Tin-stone* is, so the Tin will flow out of it with a fresh *flame*, then lift the *Coals* out of it, and let it cool, and weigh how much Tin the two *Centners* of the prepared *Tin-stone* hath given, then you may make

Section.  
2.  
In the  
Coals.

K k k k

your

CHAP account how many *Centners* of the common *Zwitter*  
XIII. yields a *Centner* of *Tin*, this I judge the surest proof.

<sup>3.</sup>  
With the  
Fluß.

Then one may weigh off the prepared *Tin-stone*, and with the *flüss* (made of *Salt-peter* and *Argol* mingled, and put into a *Crucible* and covered with *Salt*) boyl it in a little *Oven* (like to the *Copper Oars*) with the *Bellows* to give the *Proof* a strong and suddain heat: for the *Tin* will burn easily in a strong fire, and so you will find how much *Tin* the *Tin-stone* doth contain.

<sup>4.</sup>  
Upon a sudd-  
den Heat.

But the *Tin-Melters* have a singular proof upon the *bucking*, and *wash'd* unburnt *Tin-stone*, namely, to cause a shovel to be very glowing hot upon which they put the *Tin-stone* that remains upon it, and springeth not off, and doth colour it self, this they account a good *Tin-stone*, but if there be much *false Oar* among it, they may see it, and I judge it more needful to prove the *Tin* this way, because you may know whether it be good or bad, and vvhhat may be made out of it, but for those who have not long conversed with it, or well understand it, 'tis better to use the first proof.

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CHAP. XIII.

*How to try Tin-stone in the little Ovens.*



WHEN the *Tin-stone* is cleansed and burnt, then weigh an half, or vvhole pound or two of it: and set it through the little *Ovens* (as before is taught of the *Copper* and *Lead Proof*) and melt it with the *Bellows*, without any other Addition, whereby you may fully see how much *Tin-stone* it yields: but observe, if you will set the *Tin-stone* in the little *Oven*, or will melt it, 'tis to be put in  
wet

wet, and no small or smooth Coals used to it, for the CHAP.  
 Tin cannot suffer the heat, like *Copper* and other Me- XIV.  
 tals. ☞

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## CHAP. XIV.

*Of beating and preparing the Zwitter.*

**B**ECAUSE in preparing the *Zwitter*,  
 commonly so much *Tin-stone* cannot  
 be made and washed from it, as in the  
 little proof, which I do impute to the  
 useful and long observed *beating*, be-  
 cause the *Pestels* fall not (as I have men-  
 tioned above in the *Lead-work*) I judge the other *beat-*  
*ing* (though not tryed and prepared upon the *Zwitter-*  
*work*) not to be unserviceable for the dressing it; but  
 by it more *Tin-stone* is obtained, and it stands with *Rea-*  
*son*, because thereby the *Lead-ear* may be profitable to  
 the *Zwitter* or *Tin-ear* which I leave to every ones con-  
 sideration and pleasure.

There comes often many profitable works to light by  
*trying*, which otherwise would have been lost; as lately  
 the Melting the old *Tin-slacks* which have lain long  
 useles; also upon a new Method, that you need not melt  
 them as before, through the *Zwitter Oven*, but over a  
 common *Melt Oven*, which is used to raw Works, and  
 may always add fresh, making it not only much but also  
 good *Tin*.

But because commonly the *Melters* make not out of  
 one Vessel of *Tinstone*, so much *Tin* as out of the other;  
 that is not as I judge in *burning* and preparing; but the  
 fault is in their way of Melting, else it were not possible  
 to melt such *Tin* out of the *slacks*, as now is proposed.

1.

<sup>2.</sup>  
 To melt old  
 gathered  
 Slacks.

3.

I

CHAP. XIV. I must further instruct the Reader, That I am of this mind in preparing and melting the *Tin-stone*, because 'tis sure, That out of the common *Zwitter* so much *Tin* cannot be made in the great proof, with the usual beating and melting, as is to be found in the little proof, because in *beating* and *melting*, there may be loss, (as above is mentioned) therefore it follows, That to this preparing and melting some better ways may be invented, in my Judgment futable to this way.

Section.  
The <sup>4.</sup> loss in  
Burning it.

<sup>5.</sup>  
The way of  
burning it.

*Goslarish*  
*Melting.*

For the *Tin* in melting cannot suffer so much, and is more *volatile* in the fire than *Lead*, and good clean *Tin-stone* goes off as well in beating, burning and washing as the *Lead oar*: and I judge it more profitable and fit to be tryed, that the *Tin-stone* be left in *grains*, and then well burned, but not made half so clean, as to the now usual melting; and when it is melted over the light dust with strong blowing (after the *Goslarish Method*) under which the *Tin* may hide it self, and remain sure, for the *slacks* and great heat: and I doubt not but by this way, out of 60 *Zwitters* may be made more *Tin* than in the common way of *melting*, considering the light Contents of the *Goslarish Lead oars* (are as is above written) which doth not separate in the water nor are made clean: but of the *Lead* which is in it, (as it is said) one *Centner* commonly contains but five pound of *Lead*, by reason of the light *Content*, and the many *flints* vvith the *Oar*, vvhich vvill not let it vvaste avvay, and in no other *Melting* can *Lead* be melted out of it, as by the admirable vvay of *Melting* in this place is discovered; vvhereby I judge this trying vvould not be fruitless, if it vvere truly tryed, yet I leave it to every ones consideration. But if the *Goslarish Method* should not be used to this, then I knowv that through their *Melt-ovens* it can no vvays be done.

CHAP.



## CHAP. XV.

*An Instruction for Tin-stone Work.*

HERE are many sorts of *Tin-stone* Working: some being rich and some poor; in the *Stone*, and in the washing there is much hurt by the great waters which the *Tin-workers* use, by which so much of the *Tin-stone* as is flowing and subtil runs avway, so that for two, three or more Miles the *Tin-stone* is found under the *Water*: which in my Judgment may be the more profitable, because a full *Mine-Tub* of the *Wash-work* yields commonly one *Loth* of clean *Tin-stone*, and may be set over the *Seeve-work* and washed, so as a *Wash-man* may do as much in one day, as two *Boys* can bring.

Section.  
I.*Seeve-Work*

But such cleansing must be in a *Tub* of water with a hole in the bottom; that the *slicks* may fall through upon a plain harth, and yet the *Tub* be always full of water, and in this the *Tin-stone* is to be driven over the plain harth made clean and presery'd.

By this *Work*, if in one day 400 *Mine-Tubs* were filled and made clean (to which there needs but four persons) there might in a *Weeks* time almost half a *Centner* of *Tin-stone* be made clean and gathered, and this were to better profit than the other usual way; but I leave it to every one's pleasure.

CHAP.  
XVI.  
XVII.

## CHAP. XVI.

*To prove Tin Additions.*Section.  
1.2.  
*The light  
Tin the best.*

YOU must take clean *Tin*, wherein is no Addition, cast it into a round Ball in a frame (made on purpose) cut the *Ingot* clean off, and take the *Tin* you would prove against it, and cast also of it a round *Ball* like the other, and cut the *Ingot* also clean off, weigh the Balls against one another, as the pure *Tin*, and if they weigh alike, then they are of one sort of *Tin*, but if one *Ball* be heavier than the other, there is Addition either in the Melting, or put to it afterwards; but the lighter the *Tin* is, it is the better: but to know justly the *Addition*, you must have a particular weight made on purpose; and when the Addition is found, then such proof must be weighed against the clean wrought *Tin*, and the *Tin* Vessels made for the *Tin*, upon divers Mine-works, will have a difference on the weight (as is mentioned of the *Coppers*) and the Proofs will not agree.

## CHAP. XVII.

*How to prove Antimony.*

ANTIMONY is a fine heavy Oar bright like *Lead*, yet spizy, and in *Germany* and *Bohemia* it is found in great quantity, yet some better than other: and now, because it is used in some matters, I will shew the best way how to prove it: viz.  
Beat

Beat two or three pounds of the *Oar* small, put it in a pot vvith a hole at bottom, cover it, and set it on another pot, *Lute* the joynings, and set them between *Tile-stones* in the fire, that the lower part may be cool, and that the fire may not touch it, let the upper part stand in a glowing heat, so the *Oar* will flow easily, and also the *Antimony* from it through the hole, then cool it, and take out the *Antimony*, so you will see how much *Antimony* those pounds of *Oar* will produce, and accordingly you may order your self.

CHAP.  
XVIII  
XIX.

CHAP. XVIII.

Of Quick-silver.



**QUICKSILVER** is a fine red and brown *Oar*, like *Gold Oar*, partly dest and partly *insperged* in the *Mine*. To prove this *Oar* it cannot be done in an ordinary fire (as the other *Oars* are, nor melted out of it) but as a *spirit* must be driven off in a strong *distillation*, for its Metal is in the fire *volatile* like a *spirit*.

Quick-silver  
Oar.

CHAP. XIX.

How to prove Quick-silver-Oar for Quick-silver.



**FOR** the accomplishing whereof, the best way is to take half a pound of it, or somewhat less, beat it as small as half a Nut, and put it into a *Retort* or other well luted *Instrument*, and drive the *spirit* into another *Instrument* laid before it in

CHAP. in water or other moistness, thus the vapours or spirit  
 XX. will presently resolve it self in the coldness or wetness in-  
 to *Quick silver*: But if one hath no *Retorts*, he may  
 use a well luted *glass Bottle*, and set upon the *Bottle* a  
*Helmet* (which hangs over) in which water is to be put,  
 and the joynings every where well luted, that no *spirit*  
 may go out, then set the *Retorts* on the *Bottle* in a little  
 Oven, and make first a gentle fire with wood, then stron-  
 ger, thus the *Quick silver* will drive it self from the Oar  
 in the coldness or wetness, for the *Quick silver* loves cold-  
 ness and moistness, and avoideth the heat as its Enemy:  
 Now when you have found *Quick silver* in the proof,  
 weigh it, and then you may see how much the Oar was  
 which was set in, whereby your reckoning may be made  
 accordingly.

But concerning melting of *Quick silver* in the great  
 Work, do thus, beat the Oar small as a little nut, put it  
 into *Jugs* (made on purpose) in each about four  
 pound: then prepare a flat *barth* of moistned *Coal-A-*  
*shes*, on which set round *Tests*, three square fingers deep  
 after one another, and turn upon it the *Jugs* fill'd with  
 Oar, stop it well with the moistned dust, about the  
*Tests* and *Jugs*: then make a wood fire upon it, and the  
*Quick silver* will avoid the heat, and seek the cold which  
 it finds in the *Test* below.

This Labour in the great Work is to be seen in *Ger-*  
*many*, and in many places upon the *Mine-works*.

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CHAP.

CHAP. XX.

Of Iron and Steel-stone, how to know and prove them.



IRON-STONE is *brown*, and its colour is so that commonly it looks like roasted *Iron*; but the best and richest *Iron-stone* its colour is *blewish*, like to a *dug Iron*, and some of these *Iron-stones* are *Magnetish*, and draw the *Iron* apparently, which proceeds from their hidden *heat*, as shall hereafter be discoursed of.

CHAP. XXI.

How to prove whether the Iron-stone be rich in Iron.



SO this by the *Loadstone*; therefore if you will try the *Iron-stone*, roast it (though some take it unroasted) grind it small, and take a good *Loadstone*, turn or draw it about with it, and the good will hang all on the *Magnet*, stroak it off with an *Hare's foot*, and lift the *Iron-stone* up again with the *Magnet* as much as it can bear, and if at last any remains that will not be drawn up, that stone is drossy and not good: Thus you may see whether a *Mine* hath *Iron*, or whether the *Iron-stone* in it be rich or poor in *Iron*, for the *Magnet* (as is said) lifteth up no other *Metal* but *Iron* and *Steel*.

Section.  
1.  
Try'd by  
the Load-  
stone.

M m m m

The

CHAP.

XXI.

Section.

2.  
By the Steel-  
stone.

☞

3.

4.  
To melt  
Iron.stone.

The *Steel-stone* and *Iron-stone* are alike, though not in colour, some look like yellow *sparr*, this the *Magnet* will not lift up raw: nor some *Iron stone* at all; but if you roast the *Steel stone*, it colours it self, and is like the colour of the rich *Iron stone*, and then the *Magnet* will lift it very easily, and sooner than the *Ironstone*: and then the *Iron* may be made (with a long and strong heat, and with hard *Coals* in a *Secret glow*) without dammage to good *Steel*, and the common *Steel* by *Smith-working* will turn into *Iron* again.

When such proof is found by the *Magnet* that the *Ironstone* is good and rich, then the *Hammer-smiths* (with their *Additions*) use further to prove and try it, in the great fire.

The *Iron stone* being of an hot Nature, will not flow or melt with a small fire, as *Gold* and *Silver* will, but it must be a great and strong fire, and when 'tis forced to flow out of the *Iron-Ovens*, many Instruments may be cast, and its hot *Sulphur* will flow from it: also upon melting of it, somewhat of its substance will come out, and though it be refreshed in the fire with fresh *Ironstone*, yet so much of its substance will go from it as it hath lost in the first melting. But when the *Iron stone* is to be melted in the high *Ovens*, or in the *running work* (with a true *Addition* as every *Ironstone* requires) then let it force it self, yet the *twice melted* *Iron* is best for use, and most *deft* for to work.

Thus much of the *Ironstone*, how to prove what it yields in the little work: But how the *Iron* may be boyled into *Crocum Martis*, as also to get *Vitriol* out of the roasted *Iron* (of which the *Philosophers* write much) and how the *Iron* is to be wrought after several *Manners* and *Methods*, and hardned: But all this belongs not to proving of *Metals*, and so it falls not under

der my Instructions, but the *Reader* is left to find out other wayes. CHAP. XXII.

## CHAP. XXII.

## Of Magnets.

**L**OADSTONES or *Magnets* being mentioned in BOOK II. CAP. II. and in this IV. BOOK, I will discourse something of its Nature and wonderful Properties, because there is none amongst all *Jewels* which doth so naturally shew its Virtues as this *Jewel* or *Magnet*, and therefore I will let the *Reader* understand what *Serapion* an old *Philosopher* writes of it in his Book *De Simplicibus & Mineralibus*, where he sayeth thus, *Take the Magnet, lay it in an earthen Vessel, and add much of Calx viva, lute the Vessel well about with Plaster, and make a great fire under it, and let it stand in the heat till the fire goes through the earthen Vessel that it may well glow; then set the earthen Vessel with the matter to burn in a Potter's Oven, till the overluting be consumed on the Test, then take the Loadstone out of the Vessel, and mingle it again with Calx viva three or four times, and let it burn as before, and when 'tis taken out of the Oven the fourth time, then hold the Magnet in such a place that neither the Wind, Water nor Dew may come to it, nor any other Moistness, till it be cool, then beat it small and add yellow Sulphur, in like weight; Thus the Magnet is prepared, and if one do drop Water only upon it, a great fire will spring out of the Magnet, which would burn all that it toucheth.*

Thus

CHAP. XXII. This was *Serapion's* Opinion, against which I have nothing to say, whence the *Magnet* doth so vehemently love the *Iron*, and the *Iron* the *Magnet*, as though they were both of one Nature, and created one for the other; the *Magnet* being very desirous of *Iron*, and draws it to it self with its whole Power, and the *Iron* presently shews it self by springing to it, and so remains hanging on it.

The *Magnet* is also called the *Sail-stone*, for the *Sailors* look upon it as their *Chief Instructor* in their way upon the *Water*, far and near; namely, after they have touch'd the little tonge or *Needle* in the *Compass* with the *Loadstone*.

\* Mark  
Schiden,

Also the *Magnet* is used to the *Compass Needle*, in the *Mine-work*, and to direct their *Glass* and *Audits*; and also in the famous and worthy Art of \* *Separation*: and also with common *Miners*, the *Sun-Compass* is very useful; so for Brevity sake, I will conclude this *Fourth Book*: and desire the *Reader*, for this time, to be contented with the *Instructions* I have here given.

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The END of the Fourth BOOK.

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OF  
**SALT-PETRE,**  
VITRIOL, ALLUM *and* Salt Springs.

B O O K V.

CHAP. I.

Of Salt-Petre.



**I**N this Book *Salt-Petre Earth* is described, and its Properties, and how to be known, and how to make *Lees* of it, and of the *Washings* and *Boilings* of it, and the *Purifying* of the *Raw Parts* of it, and how the *Salt* is separated from the *Earth*; and cleansed with particular *Instructions* how the *weak Salt-Petre Lee* is to be made *richer* and boil'd to greater profit.

Section.  
1.  
*The Purpose of this Book.*

Also how to prove the *Flints* for *Vitriol*, and *Allum-Oar* for *Allum*, and of *Wells* or *Springs* of *Salt*.

2.  
*Of Vitriol, Alum and salt springs.*

Now, because *Salt-Petre* is much used for several uses (as may be seen in the *Four* foregoing *Books*) especially for the distilling of *Aqua Fort*. I thought it a necessary knowledge for every one who shall use the former works, that he may himself purify the *Salt-Petre*, and cleanse it from the *Earth* of common *Salt*.

Therefore, I shall, in this Book, give a large and true  
N n n n Instruction

3.  
*How to boyl salt Peter.*

CHAP. II. Instruction to all such (and others who are Lovers of the Products of Nature) and tell them of what Species Salt-Petre is, and of what 'tis made, also how to boil it, so that every one for his own Use may prepare it himself.

Section.  
4.

*Salt-Petre* is a *Stone-Salt*, which hath in it self a fullen cold fire, therefore for many things serviceable, especially for separations (of which I have written in my Books before) and of great use for making Gun-Powder from which it cannot well be spared) but 'tis to be made out of many Sorts. of *Earth*, as hereafter follows.

## CHAP. II.

*Of what Earth Salt-Petre is best to be made.*

1.  
Sheep stalls.



THE best *Earth* which is richest in *Salt-Petre*, and hath not much *Salt*, is the *Earth* out of old long-lain *Sheep-stalls*, which are very dry and not wet:

Old walls.

The other *Earth* which yields good *Salt-Petre* is the *Calx* or *Clay* of very old *Walls*, in a *Town* or *City*: where the *Earth* it self is *Salt-Petrish*, having not stood too wet, nor alwayes dry, but sometimes moistned, and then again shined upon by the *Sun*:

Old Cellars



Next to this is the *Earth* which comes of broken *Chalk-Walls* in ruin'd *Houses*, built upon vaulted *Cellars*, and lain there some years, because the *Vapours* out of the *Cellar* through the *Vault* may draw it in, as also from the daily moistness from above, and so the *Salt-Petre* is generated: and this *Earth* may be dig'd to a good depth, for it lies mixt from above down to the *Vault*, which

which (by the before-mentioned way) may be proved **CHAP.**  
how deep the Earth shall be taken for the use. **III.**

Also *Earth* which is *old* (and hath lain long in *un-*  
*plastered Houses, Cellars or Vaults*) is good; but if Section.  
+  
Unplastered  
Houses, &c. it lies not above a *Span* or half an *Ell* deep, it is not  
good to take up, therefore it must be try'd; only take  
Notice, that in those places where you intend to boil  
*Salt-Petre*, must be also of *salt-Petre*, or of a Saltish  
Nature, that they may be workt together.

Now, those places in general which lay in good fat  
and *claiy* Countreys, and the *Earth* of unplastered  
*Hors-stables*, or old *sheep-houses* (where the Sun hath  
power over it) as also the *Earth* of *Brewers* and of *Dy-*  
*ers-houses*, and of all *Alumish* places, and the *Ashes* of  
*Sope-boylers* and *Tanners*, and all other *Ashes* (whereof  
*Lee* is made) are very useful, only this latter *Earth*, do's  
yield much *salt*: which is some hinderance in boyling.

### CHAP. III.

*How Salt-petre is to be proved.*



**S**ALT-PETRE and all other saltish  
*Earth* you must prove thus, Put it in  
a little *Tub* with water upon it, which  
may cover it a square hand, let it stand  
two or three hours, then let it run off,  
and retain the *Lees*.

Then take a little *Ballance* made on purpose, pretty  
quick in motion, that it may draw a half pound of the  
proof *weight*, then have two *Scales* of *Brass* or *Copper*,  
set in each weigh scale one, and in one of them a *Cent-*  
*ner* of the Proof weight, and in the other *Scale* drop  
with the point of a *Knife* or a *Spoon* one drop of this  
*Lees*

CHAP. *Lees* and after that another, until you have weigh'd a  
 III. Centner of the *Lees*, then with *Pincers* take the *Lees* and  
 the little Scale, which must have room for a Centner of  
*Lees* in it) from the Ballance, and set it upon a foot  
 made on purpose over a little warmth, or upon a piece  
 of Iron-plate or *Lamin*, and hold a large *Candle* under  
 it, and the *Lee* will begin to boil in the little scale, and  
 let it boil till all moisture is boild in, and the remains  
 becomes *yellow-white*, and hardish, then lift it off, and  
 put it in the Ballance again, lay as much of the proof-  
 weight against it as it weighs, so you may see how much  
 Section. *Salt-Petre* a Centner of this *Lee* will yield; only observe,  
 3. If you make your proof too hot, then the *Salt-petre* will  
 be of a *black-brown*, and so spoil'd, then make it anew,  
 that the Proof may be right.

4. But that you may know whether it be *Salt-Petre* or  
*Vitriol*, take with a knife, out of the little Scale, some of  
 the rest of the matter, and lay it upon glowing Coals, and  
 when it melts and burns, and is sharp upon the tongue  
 and cold, then it is *Salt-Petre*, but if it be *Salt* and no  
*Salt-Petre*, then it *sparkles* upon the Coals, and will flow,  
 and is upon the Tongue like a common *sharp Salt*.

5. By such proof (perform'd with diligence) it doth  
 many times prevent that no unprofitable or *saltish Earth*  
 is brought in or made to *Lees*, or boyl'd off (as I will  
 shew in my following Instructions.)

After the Proof is made, observe diligently when the  
*Salt-Peter* doth burn, whether it leaves behind much *fe-*  
*ces* or dregs like *Ashes*, which will not burn, and this is  
 Salt. For, if it be found thus, though the *Earth* be pre-  
 ty rich in the Proof, yet it is not to be accounted so  
 good, as if the proof were poorer, and burned clear off  
 upon the Coals, therefore the Salt by it is not so good,  
 but it must alwayes be separated from the proof, for it  
 weak-

weakens the strong Lees, and hinders much in many things, as Experience sheweth.

But if you have not the Oportunity with the *Bal-*  
*lance* and *Weights*, or understand them not, then make a  
 little *Scale* of *Brass* of a hand-breadth, and put off the  
*Lee* which is made in it, and set it upon a few hot  
*Coals*, let it boil in, as is above declared, so you may  
 see whether the *Lee* which is made of the *Earth* be rich  
 of *Salt-petre* or not, which is a nearer way also to have  
 the *Proof*, yet he that knows it by *Ballance* and *weight*  
 is surest of his *Reckoning*.

How the *Salt-Petre Lee* is to be proved, the *Sculpture*  
 following shews.

Sculpture XXXVIII.



Deciphered.

1. *The Tub in which the Lee is to be made, out of which Salt-Petre is to be extracted, and the Can or Vessel to put water into that Tub.*

O o o o

2. *The*

CHAP.  
 III.  
 Section.  
 6.  
 Another  
 Proof.

7.

- CHAP. 2. *The lesser Tub into which the Vessel doth run.*  
 IV. 3. *The Master with his Ballance, by which he proves*  
 Section. 4. *the goodness of the Lees or Suds.*  
 5. *The Lamin.*  
 6. *The Candle.*  
 7. *Pincers.*

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## CHAP. IV.

*How the Lees or Suds shall be made out of the above-mentioned Earths.*

1.  
Lee Tubs.



If you will make a *Lee of Salt-Petre Earth*, then boyl it, if you have a great quantity, and let it be cut open, as deep as it is found good after your Proof, and put it among one another in a dry place, then cause *Tubs* to be made, of the bigness that one may contain 10 *Wheel-barrows* of Earth, so that you may have *Lees* enough, according to the bigness of the boyl-work, or greatness of the *Kettle*; now know that there usually appertains to a common great *boyl-work*, (when the *Kettle* weighs two Centners of Copper) eight *Tubs*, set them in such order, that on every side 4. (and so the eight one over against the other) must stand so far from one another, that one with a *Wheel-barrow* may run betwixt them, and the *Tubs* must stand an half *Ell* high from the ground, and every one shall have a *Tap-hole* below, and on the side, in which may be put a *Tap* of *Wood*, to be pulled out, and there must lay below under the *Tubbs* a *Channel* in which the *Lee* may run together into *Tubs* or *Sinks*, placed in the *ground*, so as the *ground* may be higher than the tops of the *Tubs*.

2.  
Of the reeds  
or sticks, to  
be used.

When the *Tubbs* are set, then lay in every one a bottom of *Wood*, full of *holes*, which doth not lye up from  
the

the bottom above two fingers high, and upon the same lay CHAP.  
 a bottom made to it on purpose of *Sticks* or *Reeds* IV.  
 (which grows by Rivers or Ditches (bound together  
 a quarter of an Ell thick) but if such stuff cannot be  
 had, then put upon the *bottom* full of *holes*, some chopt  
 Straw, a span long, and upon the same Straw, lay small  
 little *Boards*, that it may remain together, thus the *Tubs*  
 are prepared, then run the Earth with a *Wheel-Barrow*  
 into it, and when you can have *old long-layen Tanners*  
 or *Soap-boylers* *Asbes*, from old holes, put two or three  
*Wheel-barrows* full of them below in the bottom, then  
 put the other Earth (which you have proved and brought  
 in also upon it) and so do untill the *Tub* be full to a span  
 breadth, then lay it upon an hurdle or frame of *Reeds*,  
 and tye it fast, and let water be poured upon it (so much  
 that it may remain standing a good square hand above the  
 Earth) but if one could have a convenience of letting the  
 Water upon it with a *Channel*, it were better) and do this  
 so long, until the Water may remain a good square hand  
 above the *Earth*, and that it may be poured upon the  
*Reeds* or *Hurdle*, that no hole may be caused in the  
 Earth, but remain even; then let the Water stand upon  
 the *Earth* near 8 hours, then let the *Lee* run gently off  
 below through the *Tap-hole*, till it doth run *muddy*, then  
 pour the first *Lee* again upon the *Earth*, and so do till it  
 runs clear, then run the *Lees* quite off, and retain it, and  
 this *Lees* is called the *Weak-Lees*.

Then pour upon the once *extracted Earth*, common 3.  
Of weak  
Lee.  
 Water again, and let it draw out the other Water, which  
 the first Water hath left in the *Earth*, and this that then  
 comes the second time, is the after-Water, and is called  
 watering out, and such *Water* one may use instead of fresh  
 Water, upon new Earth, and that which runs from it is cal-  
 led *raw Lees* (which is strong enough to boyl) and a Cent-  
 ner made of this common *Earth*, doth usually contain 3 to

CHAP. 4 pound of *Salt-Petre*, or above, then put the extracted  
 IV. Earth out of the *Tubs* and renew it again constantly, that  
 Section. one may have *Lees* enough to boyl day and night, and  
 need not delay boyling for want of *Lees*.

4. Also there must be set above near the *Kettle*, a *Tub*,  
 out of which may run so much *Lees* into the *Kettle*, as is  
 boyled, that the *Kettle* may remain continually boyling,  
 and always full; then boyl this one day and night, until  
 a *Centner* of *Lee* may be taken out of the *Kettle*, and may  
 contain in the like Proof a quarter of a *Centner*, or 25 pounds  
 of *Salt-Petre*, which may be done in two daies, and one  
 night.

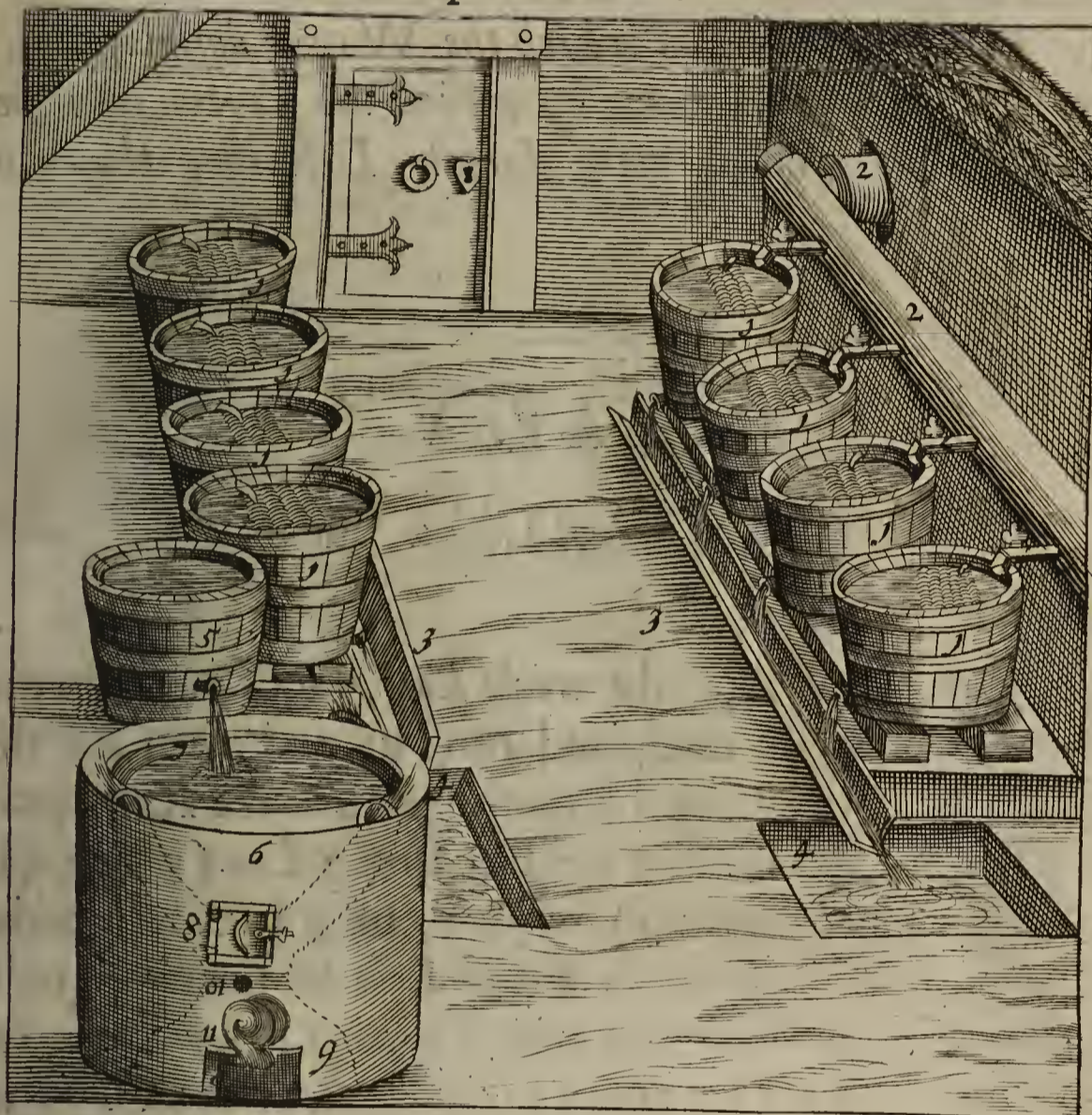
5. Then take two *Tubs* more, prepared with *bottoms* full  
 of *holes* (and the *sticks* or *red bottoms* as aforesaid) only  
 above the stuff must be laid again a bottom full of *holes*,  
 and put *straw* upon it, and then *Ashes* of good *Wood* (of  
 the best *Elm*) mingle it together, and moisten it with good  
 warm *Lees*, before it be put into the *Tubs*, then  
 being prepared, put it into the *Tubs*, an *Ell* high above  
 the *straw*, but if you can have the *Ashes* for a small price,  
 'twere better to put them together in it, and then pour upon  
 them the boyled *Lees* (containing 25 pound) boyling  
 hot water, let it run gently off, and it will first come  
 muddy, therefore put in more till it run clear.

6. When all the *Lees* is gone through both *Ashes*, which  
 Strong Lees is done that the *Ashes* may take the fatness of the *Lees*,  
 and become fit for washing, and so retain of that which  
 runs first off a part, and put upon the *extracted Ashes*, com-  
 mon hot raw *Lees*, and let the *Ashes* be watered out with  
 the same *Lees* which goes the second time through the *A-*  
*shes*, and is called strong *Lees*, then water it out the third  
 time with hot *Lees* (and this is called weak *Lees*) after this  
 the *Ashes* may be watered out with common *Lees*, untill the  
 strength comes out of it.



By the following Sculpture you are taught how the *Tubs* CHAP.  
are to be set, and the *Lees* made and boyld from it. IV.

Sculpture XXXIX.



Deciphered.

1. *The eight Tubs into which the Petre-Earth is to be put.*
2. *The Pipe with a Brass Cock, by which the Water is let into the eight Tubs.*
3. *The Channel by which the Lees falls from each Tub, and so into the Receiver.*
4. *The Sink or great Receiver of the Lees.*
5. *The ninth Tub, from which the Lees runs into the Kettle.*
6. *The Oven wherein the Kettle stands.*
7. *The Kettle on the top of the Oven.*

P p p p

8. *The*

- CHAP. V. 8. *The Iron Door by which the Wood is to be put into the Oven under the Kettle.*  
 9. *The Wind-hole in the bottom of the Oven.*  
 10. *The Hole where the Oven may be seen into.*  
 11. *The Iron Grate on which the Wood doth lay.*  
 12. *The form of the Door by which the Oven may be lookt into (being more largely Described than in Fig. 10.)*

## CHAP. V.

*How to Boyl Lees or Suds.*

TAKE the weak *Lees*, and put it in the Kettle, and boyl it, and then let the strong be gently put into the Kettle, and so boyl the first strong *Lee* (which did run off) with it, till all comes in the Kettle, and the *Lees* be strong enough, and you must sometimes, with a great *Copper-Spoon* full of holes, stir the *Lees* about in the bottom of the Kettle, (for when the *Lee* yeilds Salt it will fall on the bottom of the Kettle) then lift it out with the great *Ladle*, and always take the *scum* from it, then prove the strong *Lee* by dropping one, two or three drops upon a cold *Iron*, and when the drops stand upon it like *Butter* (that is, when they flow not off, when you turn the *Iron*) then the *Lees* is strong enough, or set the *Lees* in a little *Copper Vessel*, upon cold water, till it becomes cold, then the raw *Salt-Petre* will show it self, whereby you may see alwayes whether the *Lee* be strong enough, which may be seen also upon the great *Spoon*, wherewith you *scum* it, for if the *Lees* draw it self into a Body like an *Oyl*, the  
 proofs

proofs are right, now when the *Lee* is thus prepared, then a hundred pound of it will contain in the proof, very near seventy pound of *Salt-Petre*. CHAP. VI.

## CHAP. VI.

• How to prepare Lees for the crude and raw Salt-Petre.



**W**HEN the *Lee* is prepared (as above) put it out of the *Kettle*, into a very strong *Tub*, of good *Wood*, let it stand in it till it cool a little and the dirt settles, then the Salt will fasten it self in great *Grains* on the *Wood*, and when the *Lees* is cool, so that you may hold your finger in it, then draw it off through a *Tap*, which is to stand a span high from the bottom, and put it into great deep *Wooden Troughs*, or into *Copper Kettles*, which must stand in the ground, (the colder they stand the better) till the *Salt-Petre* grows, and in this the raw *Salt-Petre* will grow almost two fingers thick, partly *white*, partly *yellow*, and partly very *black-brown*. Section. I.

When the *Lee* hath stood in the growth two daies and two nights, draw off the *Lee* from the *Salt-Petre*, and put it the second time over *Ashes* again with other strong *Lee*, else it will be too fat and will not grow, but when the *Ashes* are not good, (so that the *Lee* cannot grow) then put strong *Lee* with other *Lee*, over new good *Ashes*, and boyl it again to grow (as above:) likewise when the strong *Lee* in the making is very muddy in the *Kettle*, and the *Salt* cannot fall because of the *muddyness*, if this happen, then only take out the *Lee* to the growth, and let the remaining *Lee*, purify through the *Ashes*.

Now

CHAP.  
VI.

Now how the Salt is to be taken out, and how the strong Lee stands growing, this following Sculpture will shew.

Sculpture XL.



Deciphered.

1. The long narrow Tubs wherein to cool the Lees.
2. The Oven wherein the Kettle is placed.
3. The Master that makes and takes out the Petre, and puts it into separating Baskets.
3. The separating Baskets.
4. The Tub out of which the strong Lee runs into the Kettle.
5. The Melters in which the Salt-Petre Improves.
6. The four Kettles standing in the Ground wherein the Salt-Petre also improves it self.

7. A

7. A strong Tub into which the Salt-Petre is to be cast  
as it improves. CHAP. VII.

## CHAP. VII.

How to purify and cleanse the raw Salt-Petre.



WHEN the *Salt-Petre* is thus made, and the rest of the *Lees* drawn off, lift up the *Kettles* or *Trays*, and turn them to one end, that the remaining *Lee* may run clear off; then take a great *Iron Spoon* such as *Bricklayers* use, and lift out the *Salt-Petre* with it, out of the *Kettles* or *Trays*, put it into a *Tub*, with a *hole* below, that the *Lees* may run clean off.

Section.

I.  
Raw Salt-  
Petre.

Some *Salt-Petre Boylers*, (who sell the raw unpurified *Earth-Petre*) they pour clean *Well-Water* upon it, that it may be well washed from the most part of its *redness*, and become *white*, what is run off they put again to other strong *Lee*; and boyl it the next boyling.

But if you will purify the raw *Salt-Petre* right and well from its *salt* and *uncleanness*, to become fair and white, do it thus; When the raw *Salt-Petre* is a *Centner* or four, cause the purifying *Kettle* to be cleansed and dried, pour in it so much *Well-Water*, that the *Salt-Petre* may be dissolved in it, then make a fire under it, let the water be boyling hot, and then put the *Salt-Petre* gently and easily in it, and turn it about with the *scumming Spoon*, that the *Salt-Petre* may be the sooner and easier dissolved.

3.  
To purify it

But while you are pouring it into the *Kettle*, let there be but little fire under, that the cleansing may remain warm, and when the *Salt Petre* is almost all put into the

4.

CHAP. VII. ter and melted, and the cleansing begin to boyl, then with the *scumming-Spoon*, put some upon the ground, and when the *Salt-Petre* hath set great *Grains* of Salt, then lift it out, which is better for it.

Section.

3.  
To make  
proofs.

When this is done, and the cleansing begins to boyl, then it brings up a *black scum*, take that off, and take a *Copper Vessel* which holds near 8 *Loths* of strong *Lees*, and make it half full of the cleansing; put it in cold water to cool it suddenly, so the *salt-Petre* will begin to shoot (and this is called a *Proof* made) then you will see whether the cleansing be yet too strong, if it be, there will come a *skin* over the *Proof* in the *Vessel*, and if so, then fill more warm water into the *Kettle*, and keep it in such a strength, that the cleansing in the *Kettle* may bubble, then make a *Proof* out of the *Vessel*, and when the cleansing shoots in it, and in the midst do remain open (so that it doth not close together) then the *Proof* is right, but if it grows together, then fill more water, till the *Proof* remain open, and pour near a pint of *Vinegar* in the cleansing into the *Kettle*, which will bring up a *black scum*, for the cleansing will purify it self of it, and when the scum is thick, take it off, and when the cleansing hath bubbled a while longer, pour in it so much good *Vinegar* as may keep it in continual *bubbling*, and then take the *black* off, as at first, this you may do the third time, and pour on *Vinegar*, till the cleansing be very clean, and do cast up no more *black scum*; Then take 3 or 4 *loths* of *burnt-Allum*, beaten small, and put it in the cleansed water, stir it about, and of this the *Salt-Petre* useth to yield fine long *flacks*, and it hurts not the *Salt-Petre*, then pour the cleansing in the before-mentioned high *slender Tub*, and cover it, that it be not cold in the *Tub*; let it stand an hour or two at most, thus the *yellow dirt* will settle it self in the bottom, then let the cleansing run out while 'tis hot, and pour it into a great *wooden Tray*, or great

To purify it  
again.

Cop-

*Copper Kettle*, which for coolness had need stand in the ground, and cover them warm that the *Lees* may begin to spring from below, else the *Salt-Petre* will grow first above and fall down, and so will not yield very long *slacks*, let it stand three or four days until it grows no more, which you may prove thus; set some of the *Lees* in the *Copper-proof Vessels*, if it grow no more in it, then take away the rest of the *Lees*, and let it clean go off, and then put the *Salt-Petre* with the *Iron Spoon*, clean out of it, into a *Vessel* with a hole below, that the rest of the *Lees* may run off, and thus you have purified *Salt Petre*.

The *Lees* which is drawn off (while it is yet *salty*) boyl it as the other strong *Lee* (in making of the *Salt* or *Lee*) and from this the *raw Salt-Petre* will grow very well. But some use at the cleansing in the *Kettle*, *Calx viva*, by which it becoms as *white* as Milk, and they let it settle in the *Tub*, which makes the *Salt-Petre* very fine, but it settles not so soon or so well in the *Tub*, and while the cleansing stands thus strong in the *Kettle*, you must not make too great a fire, for if it boyl too high, you can hardly quiet it, or hinder it from running over, whereby comes great loss, therefore it must be kept *bubling* with a little flame, and when the *Kettle* is washed, such water is to be boyled again with the strong *Suds* or *Lees*, but the *scum* which is to be taken off from the cleansing must be put upon the *Ashes*, where more *Lee* is to be put over *Ashes*, that that which is yet in it may come to profit, and when you boyl much in the *Kettle*, then lay upon it a *hard grey stone*, like the colour of *Tartar*, under which the *Kettle* useth to burn, and this is sometimes to be cleansed and separated off, with a flaming fire made under it, to make it fly off, and when the *Kettle* is empty and clean, then you may boyl it again.

The *Earth* and *Ashes* which have been extracted (whereof comes the *raw weak Lee*,) are to be put in  
heaps

CHAP. VII. into *vaults* or *Houses*, and in four years it will be fit to use, only when you use it to make *Lees*, then you must (many weeks before) dig open such *Vaults*, that the moistness may go off, and the Sun may shine in, and of this good *Lees* may be made.

Section.  
6.

How Salt-  
Peter is ge-  
nerated and  
spoiled.

But the old *Masters* do suppose, that if one could run off the *Petre* in the *Houses* under *Tylings*, it would be sooner good, which is likely, for, because of too much moistness or daily rain upon it, the *Salt-Petre* is much spoiled, and will have only a little moistness, of which it is to be generated.

7.  
To mingle  
splinters of  
Wood with  
it.

Also some of the old *Masters* do use among the *Earth* in the *Lees-Tub*, to mingle bits of *Firr Wood*, a finger long, and these they put among the *Earth*, with the *Lees* that hath been made, and set it in the *vaults* or *Houses*, and such fatness which is used in the mingling the *Salt-Petre* doth also generate and multiply, and they say when it lays in a dry place, it may be used again within a year; likewise they pour upon the light poor *Earth* in *Houses*, the old decayed colours of *Cloth-Makers* or *Dyers*, or any sharp decayed colours of *Waters* made with *Allum*, yet not so often, but that such *Earth* may have a better beginning to a good effect. Next, they bring also *Soot* out of the *Stoves*, *Furnaces* and *Chimnies*, and mixt with the *Earth*, likewise the *Ashes* of such *Lees* as is made in *Houses*, and in the *Nosel* or *Mouths* of *Ovens*, where much *Straw* is burnt, which *Ingredients* do much help to a *melioration*, that it may sooner be used.

8.

Know this only by the way, That sometimes *Earth* is found which gives *brown* thick *Lees*, which of it self is too fat to make *Salt-Petre* of, amongst which you must mingle another *Earth* more brittle and lean, and with it put some made *Lee* over it, or else you will bring no *Salt-Petre* off from it fit to be washed.

How the *Salt Peter* is cleansed, and what *Instruments*  
per-



pertain to it, they are almost alike to the XXXIX. and XL. *Sculptures* next before, and out of the same to be seen. CHAP. VIII.

## CHAP. VIII.

*How to cleanse the great Graind and black Salt-Petre Salt.*



THE *black* or *grey* Salt-Petre Salt, which is found (in boyling *Salt-petre*) below in the *Kettle* and *slender-Tub*, this may be good *Salt* for dressing *Victuals*, without any danger, only it must first be cleansed and purified thus: Wash well the *Kettle*, put in clean *Well-Water*, make under it a fire, and when it begins to boyl, take the said *Salt*, put it gently in, and let it dissolve, stir it continually, and when 'tis all dissolved, then pour the *Lees* into a *Tub*, let it settle that the *Lees* may be clear, then wash the *Kettle* clean again, put the clear *Lees* or *Suds* in it, and boyl it till the *Salt* fall in it, and then lift it out with the great *Spoon*, put it in a *Basket* above the *Kettle*, that the remaining *Lees* may run again into the *Kettle*, and lift up such *Salt*, untill no more will fall, then dry it, and so it is prepared: But some before they use it, let the *Salt* glow out, by which it becomes stronger, and what remains of the *Lees* in the *Kettle*, boyl it like the other *Suds* to a *Lees*, and put it out, and let the *Salt-Petre* grow out of it, for this *Salt* coming out of *salt-Petre*, cannot be quite without *Salt-Petre*, but there will be still some among it, which is to be cleansed off thus.

Take Notice if the *Salt* have too much *salt-Petre*, or be very *black* and unclean, the *Salt* will not become very *white* at once, for when the *Lees* begins to be strong, then

R r r r

it

Section:  
I.  
The uses of  
it.

2.  
To make it  
white.

CHAP. ascends not *white*, therefore such unclean *salt* must be dissolved in the *Kettle* once more, purified and cleansed, and then it will become very white.

Section.

3.  
To purify  
the Salt  
through  
Asbes.

There is another way of cleansing such *black* and unclean *Salt*, *viz.* one may put the dissolved *Salt* out of the *Kettle* thus warm, through the *Asbes*, over which already *Lees* hath been put, of which the *salt Lees*, will almost purify and cleanse it self, yet it becomes not all *white Salt*, but the last remains commonly *yellow*, therefore it must be cleansed once more; likewise take notice, that when the *Salt* is to be put over the *Asbes*, that it must be well watered out, that the *red* bottom may not be very *salty*, else it will come in the next strong *Lees*, and makes it very *salt*.

And thus you have a true large Instruction of the *Salt-Peter* boyling, how it is to be usually observed; but it is a tedious and not profitable boyling for this reason, because there is in a *Centner* of *Lees* but three or four pounds of *Salt Petre*, therefore the *Water* remaining must all be boyled off, which takes much time and expences, and cannot be avoided, but how it may be helped (as I myself have found out and used) I will Demonstrate in the next Chapters.

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## CHAP. IX.

*How to make the raw Lees richer before the boyling.*

1.  
The manner  
of doing it.



**A**FTER this way many *Salt Peter* boylers have searched, but the true Method (because they have not been guided by the *little Proof*) they could not find; but thus it is to be done. Take a *Tub* full of the *Lees* (of which a *Centner* con-

contains four pound of *Salt-Petre*) pour it upon new *Earth*, let it stand upon it near 12 houres, that it may run off and as much as remains behind of the *Lees*, so much *Water* pour upon the *Earth*, and let it run through to the other, and thus you will receive so much again, as you had of *Lees* before; now when this is done, then prove the *Lees*, through the *little Proof*, so you will find (because of the other pouring over) it will contain 6 pounds, this 6 pounds of *Lees*, prove again upon fresh *Earth*, and let it stand 6 hours, and then run it off, and follow it with so much *Water* as remains behind upon the *Earth*; also that the first measure of *Lees* may come only again and not more, then the *Lee* will contain nine pounds, this you may once more pour over fresh *Earth*, and enrich it; but always observe, that the *Lees* may be neither more or less then it was at the first; and to follow this with *Water* in this manner, I only mention for the proof sake, that one may be sure of the enriching, for the *Lees* by this means will contain more *Salt-Petre*, and yet the *Lees* will not increase; then to supply the first measure of *Lees*, pour in some of the weak *Lees*, so it will become the sooner and more enriched, and of such you may then soon come to a *Suds*.

And though there is much labour and dilligence thus to enrich the *Lees*, yet it comes all again, for one may make in one *Week* two or three times more *Salt-Petre*, and it spends no more *Wood*, only it requires more *Vessels* to keep the *Lees* severally for their enriching.

I will also shew howv the *Salt-Petre boyling* may be ordered to profit, first observe, because there appertains much of *Earth* to a great *Boyl-work*, and good *Earth* is not alvways to be had, but sometimes, if one cannot prove the *Earth*, very poor *Earth* is mingled amongst it, that the expences are spent upon the poor as the good, and thereby no gain to be expected, therefore I judge it  
more

CHAP.  
IX.

Section.  
2.  
The profit.

3.

CHAP. more profitable to make the *Boyl-work* vvith three or  
 IX. four *Tubs*, that one may take the best *Earth* which  
 is to be had out of old *Cities*, *Houses* and *Stables*, yet  
 not too deep, by vvhich means such *Lees* as are of 8  
 pounds content, may easily be enriched (as above) to  
 18 or 20 pounds, and not done vvith so much boyling,  
 this they may consider of, especially vvhere *Wood* is  
 dear.

4.  
 To water  
 out the  
 Earth.

When the *Lees* is thus enriched, there vvill remain  
 more *Salt-Petre* in the *Earth* (for the good *Lees* cannot  
 take it all out) then upon this *Earth* pour common wa-  
 ter, let it stand some hours and then run it off, so you  
 will receive weak *Lees*, prove it, and make the enrich-  
 ing thus, as hath been shewed, and so you may be con-  
 tinually at your work.

5.  
 To enrich  
 Lees of *Al-  
 lum*.

Now because the *Salt-Petre Lees* may be enriched  
 out of poor *Earth* (much more the *Allum Lees* out of  
 the same *Oar* and *Earth*) and may be boyled to better  
 profit, vvill by dilligent searching, be found hovv it may  
 be performed.

6.  
 Salts of  
 Oars.

After this manner I judge one may make *Lees* on all  
*roasted Oars*, and try vvhat *Salt* they may yield, for I  
 do believe that the *roasted Lead Oars* are not vvithout  
 such a salty matter, which I leave to farther Experience;  
 But how a *Salt-Petre Halls*, *Houses* or *Sheds*, are seen  
 to be on the out-sides, you will see in the following *Sculp-  
 ture*, thus

Deciphered.

1. *The fore-part of the Salt-Petre House, wherein the  
 Lee Tubs do stand.*
2. *The back part wherein the Kettle and the Oven do  
 stand, wherein the Salt-Petre is to be boyled.*
3. *The Old Pieces of dig'd Earth, out of which Salt-  
 Petre is to be taken.*
4. *The Wood used for boyling it.*

5. *The*

5. *The Servant that shaves and fits the pieces of Earth, for boyling, 5. 5. 5.* CHAP. IX.

Sculpture XLI.



It is also to be observed, That the *Salt-Petre Sheds* must be built very low, as possible, and covered with *Straw*, whereby the warmth from the *Kettle* may go over the *Tubs*, especially in *Winter*, (if *Earth* is to be had for boyling) so that the weak *Lees* may not freeze.

CHAP.

X.

## CHAP. X.

How Flints are to be proved for Vitriol, and Allum-  
Oar for Allum.

Section.

1.  
To make  
Lees of it.



IRST you must observe, that all *Flints* are *Coppery* or *Vitriolish*, and some more rich than others, the proof is thus; Roast the *Flint* very well, cool it, beat it small and make *Lees* of it, then weigh a *Centner* of it, and prove it, (as is said of the *Salt-Petre Lees*) and what remains in the little *scale*, weigh against the *weight*, then you may find how rich the *Flint* is: But that you may be sure it is *Vitriol*, try such proof upon your *Tongue*, if it be *sharp* and *sowr*, and gives a *redness* to clear *Iron*, then the *Vitriol* is good, but when the proof doth not so, then make more *Lees*, and try it in a little pan of *Lead*, that you may know what kind of *species* it doth yield.

2.

Many think that because we make *Vitriol-Lees* out of *Roast-Oars* and *Copper-Stone*, therefore we may out of *Copper* and *Silver*, &c. which is with good profit to be melted out of them, yet 'tis found, that out of the same *Flint*, and *Copper-stone*, made into *Lees*, there hath been made much less *Copper* than when it had been melted before the making them into *Lees*, by reason the *Vitriol Lees* which is made of it, hath drawn out the most part of the *Copper*, and somewhat of the *Silver*, therefore it is not to be trusted to, nor any account to be made of it.

3.  
Proof upon  
Allum.

But the *Allum-Earth* or *Shiffer*, if you prove it for *Allum*, it matters not that it be *roasted*, neither can it be done *raw* with it, as it comes out of the *Vein*, but it must  
lay

lay a while upon a heap together, to be weathered and warm'd in it self, that it may fall afunder and break out, and then you may make *Lees* of it, and you will find by the proof of the *Allum* upon the *Tongue*, that it draws it together very *Vitriolish*. CHAP.  
X.

Further, we may observe, that in the *Vitriol-Mines* (as at *Goslar* upon *Cuttemburg*, and other places) that the *Waters* which by Art are drawn out of the deepest *Mines* are for the most part vitriolish, yet some more than others, and if such *Water* might be directed in wooden *Pipes* into the *Boyling-Work*, and boyl'd for *Vitriol*, it would yield good profit; yet when this is done, you must take heed that no sweet-*Water* (which by Arts is brought into the *Mines* or other *Tiling Water*,) may come among it, but such *Waters* (as above) you may prove, and further after your pleasure make profit by them. Also on this wise you may prove all *Wells* or *Springs* of *Salt* (after the beforementioned little proof) and search and know properly how rich they be. 4.  
*Vitriolish  
Water in  
the Mines.*

And I was willing to mention these Instructions, for *salty-Proofs*, that those who are now concerned, may know how the better to manage them. 5.

Thus much, loving *Reader*, I have writ of proving all sorts of *Oars* and *Mettals*, and other necessary things fit to be known, for *proving* and *melting* them, to the good and profit of all *Mine-workers* and *young Assayers*, and for such as are ignorant of these Arts: and this I have done in five Books, most faithfully and dilligently, and also given very large Instructions, by writing and *Sculp-turing* the same; and I desire for this time that every one who loves or inclines to these Sciences, will be content with it, and accept of my good Intentions, for these are not designed for *Magisterial Artists*. 6.

Now

CHAP. X. Now in these *Books* I have not undertaken to treat of all *Oars* singly, upon preparing and melting them in the great *Works*, because I could not well discharge my self therein, in respect that it would be a greater *Task* than my present *Services* can admit of, yet I will reserve it to a farther *Opportunity*, and I will also respite my *Labour* to discover how the *Gold* and *Silver* upon the *Coyn'd Works* are to be ordered, upon diverse certain *Contents*, and so made to profit, which would require a particular and more large *Volumn*, considering that it is a great *Work* and for many years (with other things pertaining to the *Coyn'd-Works*) have been as *Secrets*, and therefore I will also let them be as *Secrets* for the present.

Section.  
7.

And although *Goldsmiths*, common *Assayers* and *Merchants*, do suppose when they can reckon some dressings of the *Crucible*, they have the perfect *Art*, yet they want the most needful and best parts; namely, they have not been with the *Coiners*, neither have they any true understanding or exercise of it, and therefore in these matters nothing could be done with fruit or profit.

8.

Now concerning the *Generation* of *Oars* and *Metals*, of which the *Philosophers* and *Naturalists* have wrote and disputed very much, I leave all of them to others with their *Rules* and *Opinions* of the *Mine-Workers*, by reason that their thoughts and presumptions, are not only uncertain, but oft-times wide and agree not together; yet I really believe, That *God* the *Almighty Creator* hath reserved these *Mysterics* to his *Almightyness*, and that *Gold*, *Silver* and all *Metals* through his *Everlasting Word*, the *Son of God* (from whom *Heaven* and *Earth*, and all things which are in them have their *Creation* and *Being*) are to this day preserved and multiplied, and that the knowledge of them are come to clear light, and published for his *Glory* and the good of *Mankind*; for which



which glorious Gifts, every one ought with pure Zeal CHAP.  
to praise and thank God from his Heart, and imploy all X.  
his dilligence and reason, so that what he may have out  
of the *Mine-Works* may be used to the praise of God,  
and to the profit, help and advantage of his Neighbors,  
whereby God the Almighty will not only bless it, but  
also richly Multiply the Possessors of it, and cause them to  
injoy it to the Salvation of their Souls.

*Now, may the Lord God, Creator and Preserver of all  
Creatures, be graciously pleased to open the hidden  
Treasures of the rich Gold Sope, also of Gold, Sil-  
ver and all Metallick Veins, for upholding the Poste-  
rity of the Poor Sons of Adam, and by blessings  
and long continuance, preserve them for his beloved  
Son, our Lord Jesus Christs sake, and that we may  
use them with thanks and praise. Amen.*

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F I N I S.

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T t t t



*Fleta Minor,*

Spagyrick LAWS,

The Second Part.

CONTAINING

ESSAYS

ON

Metallick WORDS:

Alphabetically composed, as a DICTIONARY  
TO

Lazarus Erckern.

Illustrated with two *Sculptures*.

By Sir *John Pettus*, of *Suffolk*, Knight.

Scire tuum nihil est;  
Nisi te scire, hoc sciet alter.

L O N D O N,

Printed, for the Author, by *Thomas Dawks*, his Majesty's  
*British* Printer, at the West-end of *Thames-street*. 1683.



Kind Reader,

**Y**OU are desired to take notice, That all the following words are only transciently used in the Essays, and therefore referr'd to the Capitals of the Dictionary, and the Capitals of the Dictionary are referr'd to some parts of the five Books of Erckern.

Adam *vide* Gold.

Ægypt *v.* Gold.

Ægyptians *v.* Quick-silver.

Æthiopia *v.* Gold.

Æs *v.* Brass.

Ætna *v.* Bitumen.

Affrica, *v.* Gold.

Alabaster, *v.* Marble, Plaster.

All *v.* Chemistry.

Allays *v.* Money.

Allum *v.* Minerals.

Almonds *v.* Blanch.

Alpha *v.* Regulus.

Amethyst *v.* Metals.

Antimony *v.* Metals, Minerals.

Antartick *v.* Gold; Loadstone.

Antidotes *v.* Dung.

Architecture *v.* Calcine.

Armoniack *v.* Minerals.

Aarons Bells *v.* Bell.

Arsenick *v.* Mineral.

Artick *v.* Gold, Loadstone.

Ashes *v.* Gold, Pulveration.

Asses *v.* Bone.

Asia *v.* Gold.

Atlantick *v.* Gold.

Auricalcum *v.* Wire.

Barly corn *v.* Measures, Money.

Barme *v.* Yeast.

Bees *v.* Putrefaction, Regulus.

Beergood *v.* Yest.

Beer *v.* Blink.

Black Lead *v.* Lead.

Blood *v.* Gold.

Blood-stone *v.* Polish.

Boards *v.* Planks.

Boar *v.* Bacon.

Borneo flu. *v.* Gold.

Botanist *v.* Colour.

Bread *v.* Feces.

Brimstone *v.* Minerals.

Bullock *v.* Ox.

Buxtons Wells *v.* Mines.

Calcanthum *v.* Sublimatum.

Calaminaris *v.* Brass, Mineral.

Camelion *v.* Eggs.

Camel *v.* Armoniack.

Capa longa fish *v.* Conglutinate.

- Cedar v. *Gold.*  
 Ceruse v. *Lead.*  
 Chaldeans v. *Quick-silver.*  
 Chalck-stone, v. *Lead, Lime.*  
 China earth, v. *Earth.*  
 Chiromancy v. *Measures.*  
 Cinders v. *Coal.*  
 Cinnabar v. *Minerals, Quick-silver.*  
 Clay v. *Loadstone.*  
 Cloath v. *Filtration.*  
 Coaches v. *Yellow.*  
 Coin v. *Mint, Mony.*  
 Consonants v. *Regulus.*  
 Constellations v. *Loadstone.*  
 Copper v. *Metal.*  
 Corrosion v. *Calcine.*  
 Counterfeits v. *Mony.*  
 Christ v. *Gold.*  
 Crocus v. *Verdigrease.*  
 Cubit v. *Measures.*  
 Cup v. *Pipkin.*  
 Damp v. *Evaporation, Mines.*  
 David v. *Gold.*  
 Dew v. *Feces.*  
 Diamonds v. *Metal, pulvera-tion.*  
 Discourses v. *Regulus.*  
 Devils arse v. *Mines.*  
 Dodmans v. *conglutinate.*  
 Dogs v. *Dung.*  
 Dovegang v. *Mines.*  
 Dram v. *Measures.*  
 Ducks v. *Dung.*  
 Dung v. *Eggs, Gold.*  
 Durdans v. *Petrefaction.*  
 Dust v. *Pulveration.*  
 Earthquake v. *Boyling.*  
 Ebb v. *Loadstone.*  
 Eden v. *Gold.*  
 Eels v. *Putrefaction.*  
 Eldon hole v. *Mines.*  
 Electrum v. *Metals.*  
 Elbow v. *Measures.*  
 Ell v. *Measures.*  
 Elephant v. *Armoniack and Dragons Blood.*  
 England v. *Load-stone, Water-stones, &c.*  
 English Mines, v. *Mines.*  
 Equinoctial v. *Gold.*  
 Erckern, Etimology v. *Alchimi-st.*  
 Essays v. *Assay.*  
 Europe v. *Gold.*  
 Eye v. *Needle.*  
 Fathom v. *Measures.*  
 Fermentation v. *Yest.*  
 Finger v. *Gold.*  
 Fish v. *Eggs.*  
 Flax v. *Flux.*  
 Flesh v. *Gold.*  
 Flowing v. *Loadstone.*  
 Flower v. *Fermentation, Yest.*  
 Flies v. *Putrifaction.*  
 Fort v. *Measures.*  
 Foam v. *Yest.*  
 Frankincense v. *Xiphion.*  
 Froth v. *Litarge, Yest.*  
 Fullers

- Fullers-earth, v. *Earth*  
 Fusile, v. *Fusion*  
 Gallenist, v. *Quick silver*  
 Ganges, v. *Gold*  
 Geese, v. *Dung*  
 Gems, v. *Colours, Metals*  
 German Mines, v. *Mines*  
 God, v. *Gold, Regulus*  
 Goldsmiths, v. *Gold*  
 Gold, v. *Metals*  
 God's-good, v. *Test*  
 Gums, v. *Yellow*  
 Gunpowder v. *Boyling, Pul-*  
*veration.*  
 Guts v. *Bells*  
 Guenea v. *Gold*  
 Hards v. *Flocks*  
 Havilah v. *Gold*  
 Heaven }  
 Hebrews } v. *Quicksilver*  
 Hell }  
 Herrings, v. *Ashes*  
 Hens v. *Eggs*  
 Hides v. *Bellows*  
 Hisperides, v. *Gold*  
 Holy Ghost v. *Regulus*  
 Hony-Comb v. *Putrefaction*  
 Horse v. *Dung*  
 Hungary v. *Mines*  
 Iclingham v. *Earth*  
 Idols v. *Dung*  
 Jesus v. *Gold*  
 Inch v. *Measures*  
 India v. *Gold*  
 Industry v. *Alchimist*  
 Ink, v. *Copperas*  
 Iron v. *Metals, Oars*  
 Ising-glass fish v. *Conglutinate*  
 Isop, v. *Gold*  
 Ivory, v. *Black*  
 King v. *Regulus*  
 Lapis celestis v. *Vitriol*  
 Lead v. *Metals, Oars*  
 Leather v. *Expression*  
 Lees, v. *Pulveration*  
 Leimster v. *Flocks*  
 Lethargy v. *Littarg*  
 Letters 24 v. *Regulus*  
 Leven v. *Firmentation*  
 Limbus patrum } v. *Quick-*  
 Limbus Infantium } *silver.*  
 Limpet fish v. *Conglutinate*  
 Linnen v. *Expression*  
 Linsy woolfy v. *Timode*  
 Linseed-Oyl v. *Oyls*  
 Liquid v. *Regulus*  
 Litturgy v. *Littarge*  
 Loadstone v. *Gold*  
 Lombardy v. *Gold*  
 Luna v. *Quicksilver*  
 Magnas }  
 Magnes } v. *Loadstone*  
 Magnus }  
 Magnetism }  
 Mediterranean v. *Gold*  
 Mendip v. *Mines*  
 Menstruum v. *Extraction*  
 Mice v. *Putrefaction*  
 Mercury v. *Quick silver*  
 Miles v. *Measure: Quicksilver*  
 Mill-stones v. *Quarry*  
 [ B ] Mines

Mines Royal v. Copper.  
 Mine-Counties, and no Mine-Counties v. Mines.  
 Miniature v. Colours.  
 Minium } v. Quick silver.  
 Moon }  
 Money v. Coin.  
 Mortar v. Earth.  
 Moses v. Gold.  
 Musick Instruments v. Bells.  
 Mutes v. Regulus.  
 Nails }  
 Navigation } v. Loadstone.  
 Needle }  
 Nigro Fl. } v. Gold.  
 Nilus }  
 Nitre v. Minerals.  
 Norwich v. Boyling.  
 North v. Petrefaction.  
 Oakers v. Arsnick. Earth.  
 Obedience see Regulus.  
 Officers v. Alchymist. Mint.  
 Oky hole see Petrification.  
 Onion see Loadstone.  
 Os Oris, Os Ossis see Bone.  
 Orpiment see Minerals.  
 Ox see Dragons blood.  
 Oysters see conglutinate.  
 Palm see Measures.  
 Palmistry see Measures.  
 Paper see Filtration.  
 Paradise see Gold.  
 Peat see Turfe.  
 Peacock see Dung.  
 Pencils see Coal.  
 Pint see Measures.  
 Pison see Gold.  
 Planks see Planks.  
 Planets see Colours.  
 Plant see Loadstone.  
 Plate see Silver.  
 Pliers see Pincers.  
 Plawing, see Boyling.  
 Plimouth see Calcine.  
 Poland see Mines.  
 Policy see Polish.  
 Pools Hole see Putrefaction.  
 Pound see Weight.  
 Poudor of Projection see Alchymist, dulcification, Flowers, pulveration.  
 Prayer see Gold.  
 Priest see Gold.  
 Pugil see Measures.  
 Purification see Gold.  
 Putte see Polish.  
 Quenching see Steel.  
 Quicksilver see Gold, Metals, Pulveration.  
 Ratsbane see Arsenick.  
 Reason see Ground.  
 Rebeckah see Gold.  
 Red Lead see Lead.  
 Religion see Gold.  
 Resurrection see Calcine, Gold, Pulveration, Dust, Ashes, Quick silver.  
 Riddle see Rattar.  
 Rising see Test.  
 Runt see Ox.



- Sables see *Sands*.  
 Sand see *Earth, Russet*.  
 Sapphire see *Metals*.  
 Sandiver see *Minerals*.  
 Scarlet see *Gold*.  
 Scurf see *Scales*.  
 Scruple see *Measures*.  
 Screen see *Rattar*.  
 Seeve see *Rattar*.  
 Sentences see *Regulus*.  
 Separation see *Cement*.  
 Shafts see *Mines*.  
 Sheppy Island see *Copperas*.  
 Sillables see *Regulus*.  
 Silyer see *Metals*.  
 Sinoper see *Armoniack*.  
 Skin see *Gold*.  
 Smerna-soap see *Bacon*.  
 Snails see *conglutinate, Putrefaction*.  
 Sodom see *Bitumen*.  
 Sods see *Turf*.  
 Snakes see *Egg*.  
 Solomon see *Gold*.  
 Soul see *Loadstone*.  
 Span see *Measures*.  
 Speckled see *Missy*.  
 Spittle see *Flegm*.  
 Spring see *Salt*.  
 Stanneries see *Tin*.  
 Sterling money see *Money*.  
 Steer see *Ox*.  
 Stibium see *Minerals*.  
 Stills little see *Limbeck*.  
 Stones see *Petrefaction*.  
 Sublimation see *Fixation*.  
 Sugar see *Dulcification*.  
 Sulphur see *Flegm, Minerals*.  
 Tabacco pipe see *Coal*.  
 Talck see *Minerals, Plaster*.  
 Teasle tree see *Petrefaction*.  
 Terrella see *Loadstone*.  
 Terra Sigillata, Lemnia, Arminia see *Earth*.  
 Testis v. *Test*.  
 Thane see *Athamor*.  
 Thumb see *Measures*.  
 Thummim see *Alchymist*.  
 Tide-Well see *Boyling*.  
 Tin see *Metals*.  
 Tongs see *Pincers*.  
 Touch-stone see *Marble, Needle*.  
 Travelling see *Money*.  
 Tree of Life, of good and ill see *Alchymist, Gamabez*.  
 Truth see *Ballance*.  
 Variation see *Load-stone*.  
 Venice see *Mines*.  
 Venus see *Quick-silver*.  
 Vermilion see *Quick-silver*.  
 Virgula Divina see *Xanthus*.  
 Vitriol see *Flegm*.  
 Visuvius see *Bitumen*.  
 Vitriol see *Minerals*.  
 Union see *Cement*.  
 Vowel see *Regulus*.  
 Vows see *Regulus*.  
 Urine see *Alchymist*.  
 Wales see *Mines*.

Water

Water see <i>Gold.</i>	Wooll see <i>Flocks.</i>
Wax see <i>Plaster.</i>	Wood see <i>Gold, Petrefaction.</i>
Weapon salve see <i>Bacon.</i>	Work see <i>Needle.</i>
Weather see <i>Load-stone.</i>	Words see <i>Regulus.</i>
Wells, v. Boyling, Mines,	World see <i>Vein.</i>
Wheel,	Yard see <i>Measures.</i>
Wheat see <i>Measures.</i>	Yest see <i>Fermentation.</i>
White lead see <i>Lead.</i>	Zambre see <i>Gold.</i>
Wiffet see <i>Blanch.</i>	Zaclar see <i>Gold.</i>
Withy Tree see <i>Coal.</i>	

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**T**HE *Reader* is desired to amend or connive at the Omissions of the *folio's* of the first 80 pages, and to alter these words, p. 8. l. 24. r. Tentare. p. 16. l. 15. r. Ceneres. p. 20. l. 25. r. or woolen. p. 29. l. 15. r. koinos. p. 41. l. 13. r. Warner. p. 42. l. 11. r. Moving. p. 60. l. 15. r. Lamins. p. 64. l. 31. r. Maritime. p. 74. l. 27. r. Thumb. p. 92. l. 20. dele And r. It. p. 97. l. 4. r. draining. p. 110. l. 7. r. Herbert. p. 120. l. 11. dele un. r. Drest. p. 121. l. 10. r. Coasts. p. 128. l. 11. r. Emerald l. 21. r. Lazuli: Some other there are by want of *points*, or *vowels* or *Consonants*, or misplacing of *Capital Words*, wherein I hope the *Reader* will pardon the *Printer*, considering my *Circumstances*.

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ESSAYS  
EXPLAINING  
Metallick WORDS:

Alphabetically disposed, as a DICTIONARY  
or INDEX to the whole.

Note, *T.* signifies the Teutonical or Upper German Language. *L.* The Latine.  
*A.* The Anglican or English: The rest are written at large, being but seldom used.

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AL



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**A**LCHIMIE. *T.* *Alkumy*, *L.* *Alchimia*, but by *Plautus* is writ *Orchimia*, which may well have relation to our word *Ore* or *Oar*. The Lord *Verulam* tells us, 'Tis an ART of Distilling or Drawing Quintessences out of Metals by Fire, separating the pure from the impure, setting at liberty such *Bodies* of Metals as are *bound* and *imprisoned*, and bringing to perfection such as are unripe, and this is the chief subject of this Book; now in his Lordships mentioning Fire, in this Definition, it seems only to relate to *Culinary Fires*: But I apprehend this ART looks higher, even to the use of *Celestial Fires*; from the *Sun* and *Stars*, and their influential Heats, gain'd by *Contractions*, *Reflections*, &c. which are or may be used in this *Art*, as will be shewn.

ALCHIMIST, *T.* *Alchumišt*. *L.* *Alchimišta* (from the Greek *Alkamos*, or Hebrew *Alkum*) is one that is used or skill'd in the Art of Alchimy or Chimiſtry, and therefore in

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A.

*A.* he is commonly call'd *Alchimiſt*. or *Chimiſt*, *Melter*, *Prover*, *Aſſayer* or *Extractor* of Quinteſſences; and ſuch an one was our Author. But before we fix our Title or *Epithite* to the Maſter of this Science, it is fit to ſhew the progreſſes of it; at the *firſt* ſtep to it, he is call'd, a *Miner*, or he that finds out and digs (or cauſes to be dig'd) the *Metallick Ore* out of ſuch *Mines*. The *ſecond* is the *Waſher*, or he that waſheth the *Oars* from their uſeleſs Excrements or adherences. The *third* is the *ſtamper*, that knows how to beat or ſtamp them by mills or otherwiſe into ſuch Particles as that they may be fitted for ſmelting Ovens (which are the great melting Works, but call'd *Smelting* for diſtinction from the leſſer.) The *fourth*, is the *Smelter* of the great Quantities in thoſe great Ovens or Furnaces. The *Fifth*, is the *Finer* that ſmelts them over again, and ſeparates the metals in the great Works. The *ſixth* is the *Refiner*, that melts them again ſo often as he thinks fit, till he hath brought the ſeparated Metals to their ſeveral perfections and intireneſs. The *ſeventh*, is the *Prover* or *Aſſayer*, who by *Teſts*, *Crucibles*, *Weights* and other Experiments is able to judge of all Oars, either as they come from their Veins, or made into melted, fined or refined *Metals*; and ſuch an Aſſayer was our Author in all theſe ſeven Gradations, and therefore intituled the far renowned *Lazarus Erckern*, *Berkmeiſter*, or *Chief Prover*, (which we call, *Aſſayer*) of the *Mines* of the Emperor of *Germany*, and the depending Principalities of that Empire.

In what Emperors time he lived, I cannot learn, but his five Books were printed and publiſhed at *Antwerp*, Anno. 1629. from which many of the yonger *Chimiſts* of this Age have derived their ſkill, by Copies ſurreptitiouſly gain'd from my firſt Tranſlation, about 14 years ſince, which occaſions my printing of it now, being made more perfect.

His Name, *Lazarus*, is in Imitation of the old *Romans*, *Germans* and *Belgicks*, who assumed Names ſuting to their temper, or ſome obſervable Actions: the word *Lazarus* ſignifies in Sacred Writ one that was beloved of our *Saviour*,  
 alſo

also one that was raised from the *Earth*; and, in the Parable, signifies a good poor man in *Abraham's Bosom*, and accordingly in the conclusion of his fifth Book, he shews his *Zeal* for *God's Glory*, and his true Belief in *Jesus Christ*, assisting him in his deep Knowledge of *Metallick Science*, and he might well expect, by his Humility of mind to be lodg'd in *Abraham's Bosom* (who we find was well vers'd in *Metals*;) and the *Rosy Crucius* (of whom *Majerus* and *Spagnetus* do give a full account, being a sort of *Metaphysical Chimiſts*, who do make it a chief Principle of that Science, to be strict in their Devotion towards God, and just towards men, without which they believe they cannot attain to any Perfection in this Science: also *Paracelsus* (that great *Chimiſt*) goes so far as to make the two *Trees of Life*, and of *Good* and *Evil*, and the *Urim* and *Thummin*, (and many other things written by *Moses*) to be only mystically related to this Science; but to pass by this.

His other Name is *Erckern* (*Erskerus* being but a mistake in the first Translator, for in the Original it is *Erckern*) now *Erk* in *T.* is *Oar*, and *Kern* in *T.* is *granum*, or *grain*; so that to *kern* is to *granulate* (which is to reduce *Metals* into certain proportions of the purest part which they call *grains*;) also *kern* signifies to *pulverize* any thing, and so may be applyed to *Metals*, whereby it may intend also that magisterial powder of *Projection* (of which I shall speak more:) or else it may very well come from the Latin word *Cernere*, which we English to *discern*, the Latine often using *c* for *k*; and so we do in our Language, so *kern* or *cern*, may justly signify to *see*, *know* or *judg*.

Now joyning all together, I may represent him as an *humble minded industrious man*, that knows how to judge of all *Oars*, and how to manage the Products of them, for the Glory of God, and good of mankind.

By which we may see how Goodness and Industry do improve the Fortunes and Esteems of such men, and that the exact Knowledge of this Noble Science, and Art of *Proving* or *Assaying* Metals, do raise them to be owned, and dignified,  
even

even by *Emperors, Kings, Princes* and *States*; and their very Names renoued to Posterity, as may be seen in *Histories*.

Now, I have shewn the seven *Gradations* to a *Chimist*, so I must tell you that he looks on himself in an higher degree and justly defined, according to the Lord *Verulam*, for he, not only knows all these seven *Gradations*, but also knows how to Extract *Quintessences* or several marvelous *Works* out of all, and if he would stop there (as *Erckern* doth) it were well for him, but it seems he cannot be content, unless he attains to the high *Elixir* or *Powder of Projection* or *Philosophers-Stone*, which is believed by some of them to have a power of *Transmuting* or turning all other *Metals* into *Gold*; but by woful Experience of some mens credulity, instead of turning every thing into *Gold*, they have turned all their *Gold* into nothing (*Verulam*.) But our *Author* (though it may well be supposed, that he knew much more than he writ) goes no farther in his Books, than what is safe and fit to be known and publish't; *i. e.* only concerning *Finishing* and *Refining* of *Metals*, neither stooping too low to the meaner *Gradations*, nor ascending too high to the *Metaphysical Speculations*, but leaves those subjects to other *Writers*.

Now, as for the word *Alchymist*, it is the same thing with *Chimist*, but usually taken in an imperfect or ill Sense (like *Ben. Johnson's Alchymist*) that is, one that can or pretends to counterfeit *Metals*: so that to sum up the chief Terms; an *Assayer* judgeth of the purity of *Metals*, and the *Chimist* improves this purity to *Spirits, Quintessences, Virtues, &c.* But the *Alchymist, Counterfeits* and *Adulterates* them, by making them appear to be pure, which really are not pure, but mixt with other *sophistications*, (*Verulam*.) Of this latter our *Author* is not Guilty; so as he stands for a *renown'd Assay-Master*, a good *Chimist*, and one that understood, but was not a *Sophisticating Alchymist*, nor a *Lapidarian Philosopher*, or *Metaphysical Projector*. See *Assaying*.

*Alkali* or *Alcali*, reckoned by *Doctor Wilkins* amongst  
Stones

Stones, but here and in other parts of the V. Books, call'd *Sal Alkali*, which is a *Salt* made of the Herb *Kali* or *Salicornia*; vulgarly call'd *Glaswort*: The herb is hot and dry, and therefore such Salts of that Quality are called *alcalous*, and this *Salt* is often used by our Author, as having a nature to dis-coagulate Metals, by opening their Bodies. (*l. 1. c. 32. f. 4.*)

ALIMBECK, See *Limbeck*.

ALLAY, T. *Linderen*. L. *Mitigare*. A. to lessen or *allay*. See *Money* and *Coin*.

ALLUM, T. *Alaum*. L. *Alumen*, from *Lumen*, in respect of its transparency and nearness to *Crystal*, and is accounted among the brighter stones; of this Mineral there are several sorts from several Mines, and *Allum* works erected in *England*, and they are also in many parts of *Europe*, some more acid and sharp in taste than others, by which their goodness is chiefly distinguished: and this Mineral is of great use to *Chimists*, *Dyers* and other *Artists*. *l. 2. c. 4. f. 5.*

AMEL, or to *Enamel*, T. *Eyn-brennen*, and is call'd the *metallick Calx* or *Lime*, compounded of two parts, *viz.* one of *Lead* and one of *Tin*, and being well calcin'd in an *Oven* of *Reverberation* makes the *Amel*, and in the making 'tis so delicately ting'd with variety of colours, (the Art being grown to so much perfection in this age) that all sorts of Features, Images, *Landskips*, &c. are so lively represented to the eye in a condensed work of the same, that they are as delightful and more durable than those which are done with oyl or gums, *l. 2. c. 4. f. 1.* see *Nealing*.

AMONIACK, see *Armoniak*.

ANTIMONY, T. *Speiz* and *Speiz-glass* (which is properly *Glass* made of *Antimony*) L. *Stibium*, and it is also called by some Mineralists *Red Lion*, *Wolf* and *Protens* (in respect of its various qualities). It is a heavy, bright Oar, like *Lead*, but more speizy and porous, and less ponderous, and some give it the name of *white stone* or *imperfect Metal* (because they say, it is the beginner or producer of *Silver* or *Lead*)

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and

and the extracts made out of it, are of singular Virtues of, which his late Highness *Prince Ruperts* red drops were chymically made, and given with good success for most Diseases, l. 4. c. 17.

**AQUA FORTIS**, (which for brevity is printed *Fort.*) T. *Scheid-wasser*, called by Lat. Chymists *Aqua separatoria*, and is a composition of *Nitre* and *Vitriol*, &c. and this liquor is used for dissolving and separating *Gold* and *Silver*, and hath many other excellent properties, as may be collected from the 5 Books. l. 2. c. 16. to c. 34.

**AQUA regis**, is a water made of *Aqua fort.* and other compositions, and is of a more strong and corrosive nature than *aqua fort.* and it is observable the *aqua fort.* is a specifick for *silver*, and this *aqua regis* for *gold*, for it will touch only *gold* and not *silver*. l. 2. c. 28.

*Aqua argentea*, see *Quick silver*, and *metals*.

*Aqua Vitrioli*, see *Vitriol*, and *minerals*.

*Aqua dulcis*, see *common water*.

*Aqua fontis*, see *Spring water*.

**ARGOL**, T. *Weinstein*, L. *Tartarum*, and in English *Tartar* or the *Lees* of *Wine*, which sticks to the sides of wine-Vessels, hard and dry like a crust, and therefore sometimes called *Argol-stone* from its compacted hardness, and this is of great use in *metallick Operations*, l. 1. c. 10. f. 17. and other places. l. 1. See *Feces*.

**ARITHMATICK**, T. *Rechenkunst*, L. *Arithmetica*, the *Art* of *Numbring*, or *Reckoning*, according to the T. and this Art of all others is the most assisting to the *Metallick Science*, in judging of the goodness of *Metals*, after *Fining* and *Refining* them. l. 1. c. 1.

**ARMENICK**. See *Armoniack*.

**ARMONIACK**, T. gives it the Latine Name, *Bolus Armeni*, and we *Bole Armoniack*, and I find these words of kin, both in their Orthography and Pronuntiation, viz. *Amoniack Armenick* and *Armoniack*. The first *Pliny* tell us, l. 24.



l. 24. is a Gum which he calls *Gumma Armoniaci*, of a glutinous nature (like other Gums) and so may be used for Metallick Vessels. The second *viz.* *Armenick*; I find the word *Sal* always joyned with it, and so called *Sal Armenicus*, and this Salt was antiently accounted a natural Salt, but that being now unknown to us, we use the *Armenicus*, which is made of the Urine of *Elephants* or *Camels* (as 'tis said) boyled to a *Lixivium* or Salt, and called *Sal Armenius* or *Armeniacus*, and this is of great use for purifying and refining of Metals. To the third *Armoniackus* the word *Bole* is added, I suppose for distinction sake: *Pliny*, c. 35. mentions a Stone, which he calls *Lapis Armeni*, of which he counts several sorts, but the best of those he saith, are of a *blew colour*, and calls it *verd de Azure* (being of great price and esteem with *Painters*, but the common *Armoniack* he calls *Synoper* (and we *Synople*) from a City of that name, where it was plentiful, and 'tis probable this is the same which we call *Bole Armoniack*, being of a reddish colour, and this is oft used by our Author, and for distinction the word *Gum* is put to the first, *Salt* to the other, and *Bolus* to this: which I write to prevent Errors in Medicines or Metallick Experiments. l. 2. c. 20.

ARSNICK, T. *Arsenick*, L. *Auripigmentum*, We, *Orpine* or *Orpiment*, and commonly *Rats-Bain* (being used to kill *Rats*) of *Arsnick* there are two sorts, yellow and red, (which some, by mistake, esteem to be red *Oker*) *Pliny*, l. 34. saith, it is of the same substance with *Sandarack*, and inclines to that Colour, the best of which, saith he, resembleth *Gold*, and therefore I suppose called yellow *Orpiment*.

There is also a *white* or *Christalline Arsnick*, which is compounded of *salt* and the yellow *Orpiment*, so becomes transparent like *Christal*, and from thence is made the *white Rats-bane*, and it may be observ'd this *white*, consists of two parts, *viz.* a crusty or external part, and a *Christaline* or *internal* part, and this makes metal *brickle*, the other *solid*, and of the

the *Regulus* of this mineral a good metal may be made, l. 1. c. 14. f. 1. See *Sulphur*.

ASHES, T. *Asben*, L. *Ciner*, A. *Asbes*, and these are made so by the power of *Fire*, from metals, minerals, stones, bones, earth and wood; which puts me in mind of those trees which plentifully grows in *England*, call'd *Asbes*, T. *Esschen* or *Asschen-Baum*, quod optimos cerneret efficiant (*Minflaw*) but the L. calls it *Fraxinus*, and of this *Asben-wood* I have seen the great effects of it at *Tarmouth* and *Laistoff* in *Suffolk*, for with this wood and no other they dry their *Herrings*, (which is a profitable commodity to them) and it seems that the *Salt* and drying Vapours of that Wood, do cure (for so is their term) their *Herrings* of all malignities: and doubtless that wood is most proper where it is to be used for dissolving metals, and the *asbes* of it rather than any other for *metallick* uses (except *Bone-asbes*) and especially for *Salt-Petre* which is the Subject of the 5th Book. l. 2. c. 20. f. 5. See *Dust*, *Bone-Asbes*, *Pulveration*, &c.

ASSAYER, T. *Probirer*, L. *Probator*. A. *Assayer* or *Tryer*.

To ASSAY, T. *Probiren*. L. *Probare*. Which we call also to *Assay*, *Prove* or *Try Metals*, all intending the same thing, though different in *Dialect*; but there is another Word of the like signification, which is written with an *E*. as *Essayer* and to *Essay*, &c. both are rendred, by Dictionarys to *Try*, L. *Tentare*, *Probare*.

Now I think, some have committed an Error herein, and ought to have made a more clear distinction, for I take *Assaying* to have relation only to things of *Weight*, as *Metals*, &c. from the word *As* or *Assis*, (which signifies a pound *Weight*, or 12 *Ounces*, or the whole of any substance which may be divided into parts) and especially applicable to the greatest or smallest *Coins* that are made of any *Metal*, which many times were, and still are of *Copper* or *Brass*, which the L. call *Æs*, and thereupon I suppose it is sometimes writ *Essaying* (without a diphthong) and so confounded these two words in their applications, and to confirm my just distinction of them.

We

We read in the *stat.* of *H. 6. c. 12.* that the Kings Officer of the Mint, who, (as the Statute saith) is indifferently appointed between the Master of the Mint and the Merchant (which brings Silver thither to be minted) is called the *King's Assayer*, and not *Essayer*, and in the Records *Assaisiator* not *Essaisiator*, (See *Goldman's Dict.*) And some latin Records renders it *metallorum prebendorum Præfectus*, and the *Italians*, *Assaggiatore*, and the *Belgick* calls *Assay*, *Examen Probitatis monetæ*, applying the word wholly to *Metals*, but *Essay* they define it *specimen artis*, or *Exemplum quæsitæ artis*. (See *Binworts Biglotton*,) 'tis true the *French* make the two words indifferent: yet further to support this distinction in our *English Language*, the ever to be admired Lord *Virulam* calls his excellent Observations on Men and things, *Essayes* and not *Assayes*, and so *Dr. Don* (a Critick in our Language, and in general Learning) calls his quaint Discourses on some Pieces of Divinity *Essayes* and not *Assayes*, and therefore to prevent the misapplication of those two Words (with submission to those of this present age, who write themselves *Essayers* and not *Assayers* of *Metals*) I take leave in these *Discourses* to apply the word *Assayer* and *Assaying* to *Metals*, and metallick substances, and the word *Essayer* and *Essaying* to *Accidences*, and other ingenuous Undertakings, and not to *metallick* substances, having such Authorities, as I have cited to countenance me, *l. 2: c. 2.*

**ATHANOR**, *T. Heizen thurne*, *L. Fornax*, which we also call *Kiln* or *Oven*, and indeed is only a *Furnace* of several shapes, so this is called *Athanor* from its distinct shape from others *Furnaces* or *Ovens* being like a *Thurn*, which in *Tent.* is a *Tower*; but from whence the word *Athanor* to which the name of this kind of *Furnace* is given, I cannot find, unless it be from the *Greek* word *Athanatos* which signifies *immortal*) and so the spirits of the *Metals* which are drawn from thence into lesser *Ovens*, and so into *Recipients*, do thereby perfect *Quick-silver* which may be said to be of an immortal nature.

Or else from the *Saxon* word *Thane*, which signifies *No-ble*,

ble, as also a *Servant*: and thence called *Athaner* or *Athamor*, because it hath those two properties, as being the most noble of all *Furnaces* for *Metals*: and also the most *serviceable* in the *operations* of *refining Metals*, l. 2. c. 7. f. 2. See *Ovens*.

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**B**ACON (signifying here the Fat of *Hogs* or *Swine*) the Original of which word I cannot trace, with any satisfaction to my self, either from the *T. Speck* or *L. Lardum*, nor from a *Boar*, *T. Eber*, which is pretty near *L. Aper*) nor from *Sow*, *T. Saw*, *L. Sus* and *Scrofa*, nor from *swine*, *T. Schwene*, *L. Porcus*, but refer you to *Skinner's Dictionary*. And though this is oft mentioned by *Erckern* for greazing of Instruments, yet in respect of the Salt in it, I conceive it were better to use the fat of a *Boar* (especially when any *Metal* is concern'd) because I know it is as effectual in curing of wounds at distance, as the so admired *unguentum Armarium*, commonly called the *Weapon-salve*; and since it hath such a kindness to *Metals*, I know not how it may not be better used than *Venetian* or *Smerna Soap*, for improving *Gold*, *Silver*, *Tin*, &c. and so in stead of *Gold-soap* call'd *Golden Bacon*. l. 2. c. 4. l. 4. c. 15. l. 5. c. 10.

**B**ALLANCE, or a pair of *Scales*, *T. en wagmit Zwyen schustun*: but the *L.* call it *Bilanx*, *habens duas lances*, or two little Vessels to contain the things to be tryed, and also *statera*, because it demonstrates the state of the thing in question, and the *tongue* of this Ballance is in the *T. Wigzunglain*, *L. Lingua*, and *Examen*, because by standing in an *equipoisure* or not, it doth as it were speak or tell you the difference or certainty of the  
Weights,

Weights, in question, and the Latine hath another word for it, *viz. Trutina*, from the Greek *Trutane*, which not only signifies a *Ballance*, but a dilligent examining, or good advice and judgment, and from this *Trutina* we borrow the word *Truth*, and as the natural *tongue* of men speaks the truth of the Heart, so this artificial *tongue* speaks the *truth* of the *Ballance* and *Weights*, and this *Ballance* is very necessary to the performance of this *metallick science*. l. 1. c. 35, 36, 37.

BEAM, the word is applyed to the *beam* of an House, and the *beam* in the eye, the *beam* of a plough, a *Weaver's beam*, but though we use the same word for many things in English, yet they all differ in other Languages by distinct words: but this is called *T. schnalwag*, and in Latin the same with *Ballance*. See *Ballance*.

BELL, *T. Schelle*, i.e. *sonitus*, that which yields a sound, and it either comes from *Belle* an adverb signifying that which is pleasing to the ear, or from tunable Instruments that were used *in Tempore Belli*, and though by the *Italians* they are called *Campane*, upon pretence of their original, from *Campania* a noble region in *Italy*, yet we find in *Exod. 28.* that there were *golden Bells* upon *Aarons Vest*, which all the Versions into Latin call *Tintinnabulum auri* (of which the Interpreters give little account) and certainly they had little or no sound; but the metal of our bells have no gold in them, but what is casually mixt with other metals, for they are compounded of *Copper*, *Tin* and *Brass*, and a little *Silver*: sometimes the Artists or maker of these are called *Bell-founders* *T. Glockengiesser* from *Gloken* which we call *Clock*, by changing *G* to *C*), and the *art* of mixing, making aud casting them (in respect of their diversity of sounds) is of as transcending a nature as any one *art* or *science*, for the proportions of Ingredients are according to the great skill and Judgment of the Founders adequate to their various uses.

Antiently, and still, solemn *Prayers* are used at the casting them, and formerly they were with great Ceremony *baptized*,  
pre-

presuming that many spirits did attend them: and I remember an old sexton did affirm, That by the found of a *Passing-Bell*, for one dying and dead, he could tell how many hours or days after, some other of his Parish should dy: But whether this *prognosticating* quality be in them, I shall not dispute, but we are certain, that the *Harmony* of a *Confort* of them, are very pleasing to musical ears; and 'tis observable, that this *Art* is only from *Metals*. l. 1. c. 18. And not only this of *Bells*, but most of the choice *Instruments* of *Musick* were and still are either in the whole or in parts composed of *Metals*; Such as are wholly of *Metals*, are *Trumpets*, *Sag-bots*, *Cimballs* (*soft* and *triumphal*) *Organ Pipes*, &c. such as are in part, *viz.* the strings of the *Harp* (which we now call the *Irish Harp* (being strung with wire) in distinction of the *Welsh Harp* strung with *Guts-strings*) also the strings of the *Harpicon*, and *Poliphant* (which I have often heard with great pleasure, but now out of use) also the *Tabaret*, and the *Cittern*, though now of small esteem, yet was devised by *Amphion*, *Pliny* l. 7. p. 187. and many others, amongst which I must not forget the *Monochord* or *Tuba marina*, whose Entrals are curiously composed of *Metals*, although the string, which stirs up the reverberating Spirits of the *Metal*, is composed of *Guts*. Now as *Petrus Bongus* hath writ a *Book de sacris numeris*, and *Jonston de sacris Arboribus* (with *Sculptures*) I wish some would write *De sacris Instrumentis Musicae*, with their *Sculptures*, especially of those wherein *metals* are imployed, for doubtless the subject would afford excellent variety.

But besides this musical part of *Metals*, the word *Bell* is also applied to a *Glass* with a round bottom and long neck, which the *Chimists* call a *matrass glass*, or *long Bell*, *Sculpture* I.

**BELLOWS**, T. *Blasꝛbalgh*, and to blow *Geblasꝛ*. L. *Follis* & *follescere*: of these there are three sorts mentioned in *Erckern*, 1. the *Philosophical Bellows*, 2 The *great Bellows* (which requires eight *Ox-hides*) and 3. the *common Bellows*, which *Smiths* also use, and others for common fires, as you often find in the *Sculptures*

Sculptures, and all these in imitation of the nature of a *Cow* Beast, which in drawing in and forcing out her breath, is said to *Bellow*.

**BLANCH**, T. *Blanck*, *Weifs* and *Bluk*, all signifying *white*, or a white *Silver* or *Tin*, when it is melted, for the meer *Oar* of *Tin* is of a *ruddy colour*, and *white* when melted; and this by the Translator of *Weckerus*, is called *Blenck*; which word I like, (though I find it not in any Dictionary) for I had a Mannor in *Suffolk*, called by the name of *Blenches*, and it appeared so in my *Antient Court Rolls*, for that the Soyl of the Mannor, consisted of a white Clay and Chalky temper, and the next Village is *Wisset*, which consisted also of the like Soil: *Blench* and *Wiefs* both signifying *white*, so that *Blench* and *Blanch* have the same signification of *white*, and so the word is used for the *whitening*, *blenching* or *blanching* of *Silver*; the word is also used to *Almonds*, *viz.* when the superficies or dull part is taken from them by boyling Water, they are then called *blencht* or *blancht Almonds*. See Bone Ashes.

**BISMUTH**, is a *Crude Oar* or kind of *Silver* *Marchasite*, and of a white, hard and brittle Body, and I conceive is the same which *Erckern* calls also *Wismut*, or *Wismuth Oar* and *Spelter*, l. 4. c. 10. and sometimes called *Tin Glass*. See their Alphabets.

**BITUMEN**, is accounted both among *Gums* and *Pixes*, and also among *Sulphurs*, but that which *Erckern* speaks of, intends *Brimstone*, which the T. calls *Schwebel*, L. *Sulphur*, and this is either *Natural*, from the *Lake* called *Asphaltis*, (where once *Sodom* and *Gomorrhah* stood, also from the vomiting of the *Hill Aetna* and *Visuvius*) or *Artificial* made by *Fire*.

See Minerals.

**BLACK**, See Colours.

**BLEND**, or *Blent*, T. *Ablinderne*, L. *Miscere*, A. to *Mingle*, that is, when *Metals* are *blended* or *mingled* in lumps. l. 4. c. 2. &c. And this word is much used in the *North* parts of *England*, for *mixt* or *mingled* matter, which some call *Hots-Potch*. [F] BLEW,

BLEW,

See Colours.

BLINK, T. *Blinkin* or *Blicken*, L. *Micare* and *Nictare*, A. to Shine, it is commonly used to those that are *blear Ey'd*, or often *twinkle* with their Eyes: it is also applyed to dead and *sharp Beer*, and to the *broufs* or *loppage* of Trees, given to Deer (see *skinner*) but in our Author only applyed to *bright Oars*, or melted *Metals*, l. 1. c. 23. &c. & l. 2. c. 24. viz. *blink Gold* and *blink Silver*, that is *bright* or *clear Gold* or *Silver*.

BLOOD, T. *Blut*, L. *Sanguis*, apply'd to the *Bloud* of *Oxen*, &c. and is often mentioned as a good mixture, for Instruments and Cements for *Metallick uses*. See l. 2. c. 20. and Ox.

BOYLING, T. *Seiden* and *Kochen*. L. *Coquens*, l. 5. c. 7.

f. 1. we have many words for this, tending to the same sence, and yet with some Gradations, as when any liquid matter begins to stir with the heat of the Fire, we call it *simporing*, it may be from *simpo*, a Pot wherein the old *Roman* and *Gretian* Priests were wont to drink their cheering Liquor, and therefore the word *simporing* is used for *smiling*, and when it stirs more, 'tis called *seething* (which differs little from the T. *Seiden*) when it stirs to bubble, it is called *Boyling*, from *bullā* and *bullire*; but antiently *Boyling* was called *Plawing*, from L. *Plaudere*, to *rejoyce*, because the fire had the full effect of the heated liquor, and therefore the *Psalmist* saith, *Plaudent Flumina vola*, let the *Floods* clap their *Hands*: i. e. let them *plaw* or *rejoyce* in their *plawing* or *boyling waves*, but I do not find my sence of the word *plawing* confirmed in any Dictionary, as I can now peruse; but this I shall affirm for the Sence and Antiquity of the Word, That there is a *Marsh* in *South-Walsbam* in *Norfolk*, belonging to the now Duke of that County, which with other *Marshes* were gain'd from the Sea, in the time of the old *Romans* (as 'tis generally said) to which my Grandfather and my self were Tenants for near an 100 years, and in these *Marshes* there was one parcel called by the name of *Plawing-Well Marsh*, within 3 miles of *Yarmouth*, and about a mile from the



the Sea, and the Marsh is so called, and stiled in Writings, from a *Well* or place in it of about two yards broad, and about 18 Inches deep, only in the middle of it is a little *hole*, the bottom of which I could not then fathom by any Pole or Instrument that I could get, and from that *hole* the water constantly *bubbles, boils up* and *playes*, which was the word used in the *Lease*, and in other Records sufficient to justify the Antiquity of the word.

Now having spoken what I can of the word, give me leave to speak of the water, which keeps at one *scantling*, neither swelling higher nor decreasing; but if it decrease at any time, it foretels a dearth) so that the motions of it cannot be attributed to the neighboring Motions of the Sea (which are *regular, lunary* or *ventilary*) nor any other cause that I could find; unless it be from a constant motion of Cattle (grazing in these and the neighboring marshes, which being only thin & grassy coverings of the waters, those beasts by *quassation* and constant compressure of such *flexible* grounds, may easily cause this *Ebolition* or *plawing*) I confess, I am the more content with this reason, because we daily see, that a little *Compressure* in a large vessel of *liquids* will make it rise and run over, and we often find in solid *Bodies*, Compressure will have great effects at distance, as in the year 1648. when the Committee-house at *Norwich* was blown up, by the firing of 40 barrels of *Powder*, it caused by *compressure* such a motion in the *Earth*, that at *Thorp Market* (15 miles from *Norwich* (near *Cromer*) Mr. *Allen* who dwelt there in good repute) told me, that as he was sitting in his Parlor there, he was very sensible of the *quaking* of the *Earth*, which upon Information of what had past the day before at *Norwich*, and comparing the punctual time, he found the shaking was caused by that *Gun-powder*, and I, being then in the *Country*, soon after went into the *City*, where I observ'd, that all the *lower windows* of the *City-houses* were shattered by the *Air* and *Earth*, but the *upper windows* (that had only the more tender motion of the *Air* to offend them)

them) had little hurt, and this was general, except in Churches whose *Windows* were all shatter'd, having no floors to defend them against the motion of *Earth* and *Air*.

I was pleas'd with these outward accidental causes, but soon after I saw a Spring on one side of the highest Hills in *Darbyshire* within the *Peak-Forest*, and 30 miles from the Sea) that eb'd and flow'd four times in the space of an hour, call'd *Tides Well*, and for this I will not pretend to give a *Reason*, being so far from the Sea, or any probable outward cause.

**BOLUS**, see *Armoniack*. It signifies a certain proportion; from whence we might have the word *Boul* or *Bole*, which is used by *Miners* to measure out their dig'd *Oars*, both for the *King*, *Proprietor* or *themselves*, or for other uses.

**BONE** (*Asbes*) *T. Bein* (*Asben*) *Lat. Os & Ciner. A. Asbes*, and from *ciners*, *cinders*: so as the *Latines* have no proper word for it, but *Ciner* the *Cinders*, or *ashes* of *Ossium*, or *bones* in the plural. Now the *Latines* have the like word *Os* signifying a *mouth*, distinguished in their *Genitive* cases, one making *Os*, *ossis*, the other *Os oris*, one signifying *spiration*, from the *Greek*, the other *duration*, and they may well be coupled, for the *nourishment* which goes into the *mouth* gives *nutrition* to the *Bones*, and is the *Original* of its *duration* (of which I have writ more fully in my *Fodinae Regales*) and our *Author* gives several *Directions* what *Bones* are fittest to be used (to the making of *Tests* and *Crucibles* for dissolving *Mettals*) either of *Beasts* or *Fishes*, of which you may see his *Opinion* in several places, l. i. c. 5, 6, 7, &c. See *Asbes*, *Incineration*, *Pulverisation*.

Now *Pliny N. H. l. iii. c. 37.* tells us that the *bones* of *Asses* have a more musical nature in them (being made into *Pipes*) than any other *bones*, so that it may be worth the *Trial* for *Bell-Founders*, who make their *Furnaces* and *Tests* of *Bone-Asbes*) to try if *tests* made of *bones* of those dull *Asses*, in stead of other *bones*, can make their *Bells* of a more active found.

The

The ordinary *Bone-Ashes* made of *Beasts* is a considerable *Trade* about *London*, not only for *Goldsmiths*, &c. but for our *Mines* in *England*, for whilst the *Leasees* of our *Society* did work the *Mines* of *Consumlock* and *Talibont* in *Cardigan shire* in *Wales* (two old *Roman Mines*, as I have shewn else where) every year there were at least 800 *Tun* sent from hence thither by *Sea*; by which may be guessed what is, or might be, spent in the other 28 *Mine Counties* in *England* and *Wales*, if our *Mines* were duly set on work, but they being neglected, we send great quantities to other *Nations*, for the same use; for which the *Merchants* pay outward 6 *s*, 8 *d*, for every thousand *Bones*, and we pay for their bringing them into us 1 *l*. 5 *s*. for every *Barrel* of their *Ashes*, which we might burn and employ for ours.

**BORAX**, *T. Borrax. L. Borax*, and *Christocolla*, which *Pliny* calls the *Ordure* or *Dung* of *Gold*, yet *Gold-smiths* and *Silver-smiths* use it for their chiefest *sodering* of *Gold* or *Silver*; and joyning one *metal* with the other, and indeed bringing all *metals* to perfection, besides it hath medicinal properties, *l. 2. c. 4. s. 2.* and in many other places.

*Pliny* reckons it among *Minerals*, and describes it to be a *green Earth*, but of four sorts, the *best* from *Copper Mines*, the *second* from *Silver*, the *third* from *Gold*, and the *fourth* and worst from *Lead*, he tells us also of an *Artificial Borax* which he saith comes from a *putrified Vein* of *metals*: there is also another kind made by *Art* of *Rock Alum* and *Bole Armoniack*, and other *Ingredients*, which is used also by *Goldsmiths*: But the right *Borax* hath another quality, for it being mixt with *Arsnick*, it takes off the poisonous quality of the *Arsnick*, whereby it may be safely put to *metals* as a *dissolvent*.

**BOTTLES**, *T. Krugs.* See *Instruments* and their *Cruises*, *Jugs*, *Pots*, &c.

**BOTTOM**, *T. Boden, l. 1. c. 33. L. Fundus. A. Foundation*, or the lowermost part of any thing: the word is also used for a *bottom* of *thread*, *T. Vin. Gleuen* or a *claw* of

*tbred*. L. *Glomis*, which is only the Foundation on which the *tbred* is wound, and so call'd the *bottom*.

BRAN, T. *Kleyen & Gruesck*. L. *Aplanda & Furfur*, because it makes a double theft, by taking away it self, and also much of the good *flower* with it: however this *Bran* is very useful, by its mixtion with such stuff as is used for *glasing* and strengthening the outward and inward parts of such earthen *Pots* or *Vessels* as are made for *Metals*, by making the matter stick the more close and firm, and is it self destroyed like many innocent men, to make way for others. l. 2. c. 20. f. 6.

BRASS, T. *Ertz*. L. *Æs*: and it is a great Error that most Writers run into, by promiscuously giving the title *Æs* for both *Brass* and *Copper*, as if they were the same *Metals*; whereas *Æs* or *Brass* is not a proper *Metal*, but compounded of a *Metal*, viz. *Cuprum* or *Copper*, and *Lapis Calaminaris*, or *Cadmie*, which is a *mineral*, and from the mixture of these two, *Brass* is made, as may be seen in *Erckern*, lib. 3. c. 28. which in T. is called *Galmay*. Now there is of this *Calamin* two sorts, *Natural*, as in the third *Book*; and *Artificial*, l. 4. c. 8. f. 7. made of the *dregs* of *Metals*, but the *natural*, he saith, comes from *Britain*, and indeed we have mountains of it, especially in *Glocester-shire*, *Sommerset-shire*, and *Notinghamshire*: but we let the *Calaminaris* go for *Ballast* into *forein* parts, in very great quantities, before it be wrought, so as the best *Brass* beyond *Seas* is made of our *stone* rather than their own, which deserves a further consideration: and I remember about 30 years since, one *Demetrius* a *German*, did set up a *Brass-work* in *Surry*, and with the Expence of 6000 pound (as he told me) made it compleat and to good profit: but the *forein Merchants* joyning with some of ours, found wayes to bring him into *suits*; and meeting with no encouragement, he was at last necessitated to submit the work, to his own ruin, and unspeakable prejudice to the Kingdom, in loosing so beneficial an Art, having here both the best *Copper* and *Calamine* of any part of *Europe*. See *Stones* and *Copper*.

Now

Now whereas *Pliny*, *Cap. 33.* speaks of about 18 several *Mines* of *Brass*, we must not understand it as a specifick *Metal*: though the word *Æs* is vulgarly applyed to both, but those *Mines* were either *Copper mines*, capable of being made *Brass*; or so many several sorts of *Lapis Cadmiæ* or *Calamin*, from the composition of all which with *Copper*, *Brass* was made more or less both in *Quantity* and *Quality*: and this *Art* of composing it, is said, by him, to be first invented by *Cadmus* a *Grecian*, contemporary with *Joshua*, in whose time the word *Brass* is first mentioned in the *Sacred Story*, *Exod. 25. 3.* And it is observable, That though in the composition of *Brass*, there is more of the *stone* than of *Copper*, and that *Copper* is a *Metal*, and that other a *Stone*, yet it takes a new name of *Brass*, and not its own, or of the *Metal*, *Copper*: and being thus made *Brass*, it is an *Imitator* of *Gold*, both in *Colour* and in many *Virtues*, and in such esteem, that the *Roman* Treasurers were call'd *Tribuni Ærarij*, rather than *Aurarii*: and *Camerarius* says, that the *Ægyptians* (long before the *Romans*) had so great *Veneration* of *Brass* that they made *Images* of it, and laid them in the graves of their *Kings*, to preserve their *Bodies* from *Putrefaction*, and to men of lesser quality they nailed their dead bodies with many *brass* nails.

Also *Virgil*, *Horace* and *Homer* are all full of their *Encomiums* on *Brass*, and therefore it may well have the honour of a seventh *Metal*, though compounded of a *Mineral*. Now as the common *Brass* is of a *Goldish* colour, so *Pliny*, l. 34. c. 11. tells us, of a white *brass*, (which is no other (as I conceive) than *Brass Tind-over*, and called *Laten*, or *Auricalcum*. See *Latten*,

BRICK, A. *Brick. T. Gabachen-stein* or (a stone made by *Art*) L. *Later*, a *side*, because 'tis used both to *outside* and *inside* of *Buildings*; as antient as the *Ægyptians* who forc'd the *Israelites* to make it: the *Makers* of it is called, *T. Bachen-strein-lin*. L. *Laterculus*. l. 5. c. 7. f. 1.

BRICKLE, T. *Zee bruch-lech*, L. *Fragilis*, and this we vulgarly call *brittle*, but doubtless it come from *Brick*, the nature

nature of which is *fragile* or more easy to be broken in pieces, and so made into *Powder*, which both whole and in *Powder* (as those from *Tile*) are used by *Assayers*. l. 1. c. 32. f. 3. l. 2. c. 44. f. 2. &c.

BRIMSTONE, see *Bitumen*, *Sulphur*. l. 1. c. 16. f. 1. thence *Bitumenous*, *Sulphureous*.

BRITAIN, See *Mines* and *Mineral Countrys*. l. 3. c. 28. f. 5.

BROOM, T. *Bassem*, L. *scopa*, A. *Besom* and *Broom*; but I conceive this word is from the Plant, which we call *Broom*, (T. *Ginster*, L. *Genista*) of a flexible nature, and so used to sweep *Rooms*.

BROWN, T. *Braun*, L. *Fuscus*. See *Colours*.

BRUSH, T. *Buerst* (and yet to brush, they say *Kethern*) L. *Scopula* and *verricula*, *vestes purgare scopulis*, *Sculpture* 7.

BUBLING, *Ein Wasser blasen*, from T. *Blas* a *Bladder*, being but a more durable *bubble*, L. *bullae*. l. 2. c. 35. f. 7.

BUCK, *Bucking*, and up-*Bucking*, and to *Buck*, used often in the 2, 3, 4 & 5 Books, in the T. is *Lawgen*, L. *Lixivare* from *Lixivium* or *Lee*, (see *Lee* of *Asbes*) but the *Italians* call it *Bucato* or *Washing*, from whence our word *Buck*, or properly *Buc* (to distinguish it from the Male of a *Doe*) is called also *Buck*, which may have its name too from *Bucceto*, from his frequent mingency, pissing or making *Water* oftner than *Females*, and this word *Bucking* is applyed often to those that are *Washers* of the filth out of *Linen* or *Cloaths*, which the common people use to do with a piece of *broad* and *thick Wood*, which they call a *Clapper* or *Bat-staff*; but for more Expedition, the *Fullers* have invented *Mills*, with several *Stamps* for their *Cloths*, which by the force of *water* do raise and let fall their *stamps*, by which the *Fullers-Earth* with the *Water* do make our *Cloaths* fit for use; but whether the *Metallists* did teach them that *Art*, I shall not enquire, only the *Metallists* which we converse with here, have two ways of *Bucking* or *Washing* their *Oars*, from the dirt or *Earth* about them; one by a *Mill*, which they call a *Smelting-mill*, by which with the force  
of

B U                      W O R D S *Metallick*.                      C A

of Water, certain Stamps or Hammers do beat and wash the Oars, and those Workers are called *Smelters* at the Mill, and after that, there are other lesser *Buckings* in *Mortars* and *Tubs*, to prepare the Metal (more free from Rubbish) for the Melters; See Smelting Melting, and Menstruum.

BURNING of *Metals*, *i. e.* reducing them to *Ashes* or *Powder* for use. *l. 2. c. 2.* See *Ashes*, *Calcination*, *Roasting*, &c.

C A



C A

CADMIA, See *Calaminaris*.  
 CAKES, T. *Schiben*, or pieces of Metal, melted into the form of Cakes. *l. 3. c. 26.* By this word *Cake*, we must not understand such *Cakes* as in Latine are called *Placenta*, from *placere*, to please the Pallat, by their several pleasant Ingredients; but here it relates only to the form of it, sometimes *round* and *Convex*, but mostly *Flat*, like pieces of *Plate*, and therefore the *Refiners* (for distinction) do call *Lead*, cast into a solid body, *Sows* and *Pigs*; *Tin*, *Blocks*; and *Iron*, *Barrs*; but *Silver*, *Gold* and *Copper* so cast, they call *Cakes*; and *Copper* sometimes *Rose-Cakes*, or *Cupri Rosa*; and though they be not *Edibles* (or bear the name of *Placenta*) yet without *Mony*, which is derived from those metal'd *Cakes*, we could not have such things as are *placentious* or pleasing to us.

To CALCINE, *Calcinate*, *Calcinize* and *Calcination*, T. *Calcineren*, L. *Calcinare*, both Languages making it a compound of two Words, *Calx* for *Lime*, and *Ciner*, *Ashes*, which in a metallick sence, is to reduce *Metals*, by *Fire* to a *friable* or *brickle* temper, like *Lime*; therefore *Lime* is called

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onely in Latine, *Calx*, and we from the word call our *Lime-stone*, *Chalk*, which being burnt, we call *Lime*, and this burning we call *slacking* (according to the Teut.) and before it is burnt, *Unslackt*, *unburnt*, or *uncalcin'd Lime*; and being burnt or *slackt*, called also *Calx viva* (which is oft mentioned by our Author) and A. *Quick-Lime*, or that which hath by *Fire*, as it were) an additional *Life*, for metals seem to be dead in their *Oars*, but by this *Calcination* revived, to hint to us the advantages of our *Resurrection*, by the general *conflagration*. 'Tis true, there are other ways of *Calcination*, especially of *Metals*; viz. by *corrosion*, *Immersion*, *Amalgamation*, *Cementations*, *Fumigations* and *Illinations*. (See *Salmon*.) yet none of these can be performed without *Fire*: but to return to the common *Lime*, as it is fitted for the use of *Architecture*, it is mingled with *Water* and *Sand*, and then called *Mortar*, and according as the *Lime* and *Sand* are in goodness, so the *Structures* by it are made more durable, and therefore it is thought, That we had all our *Sand* for our *Mortar* (with which our antient Churches were built) out of *Italy*; and the *Fort* of *Plymouth* (built by his present Majesty) recompensed my Journey thither, the *Grass* of which is hewn out of *Marble*, and the *Mortar* also made of *calcined Marble*, and their *Sand*, which makes that *Mortar* as compact as the *Marble* it self, but what kind of *Sand* or what *Proportions*, I did not then enquire. Now there are two words in L. which pass under the same *Orthography*, viz. *Calx* for *Lime*, and *Calx* for the *Heel* of a man, (or end of a thing) so as I may conceive that our *Metallick* and *Artificial* word *Calx* for *Lime*, is borrowed of the Natural word *Galx* for *Heel*, because the *calcining* of *Metals*, do as it were determine its *Life* for a better, because those *Metals* which lay dully in the *Earth*, before their *Calcination* are by *Calcining* and *Refining* made more active and passable throughout the *World*.

CALAMINARIS, See Brass, and Sculpt. 35.



CALIFY, T. *Warme, Werme, L. Calefaccre, A.* to make warm.

CALX, See Calcine.

CAPUT MORTIS, (for brevity *Mort.*) is the matter or sediment of *Metals* (or of other things used in *Chimical Dissolutions*) which remain at the bottom of a *Furnace* or *Stillatory*, *thick* and *dry*, chiefly from *Metals* and *Minerals*; *viz.* when all their *Spirituons parts* are drawn off, the remainder is call'd *Caput Mort.* or *Feces.* See *Feces.*

CARRAT (signifying a weight) is a *French* and *Italian* Word, much used by our Author in his second Book; and it seems to come from the *Arabian, Kirat:* (see *Holioak.*) but *Cotgrave* saith, That *Goldsmiths* and *Minters* esteem it at a third part of an *Ounce*, and among *Jewellers* and precious *Stone-cutters*, but the 19 part of an *Ounce*; so as eight of them are but one *Sterling*, and a *Sterling* is the 24th. part of an *Ounce*, and 3 *Grains* of *Assize*, or 4 *Grains* of *Diamond* weight make a *Carrat.*

*Torriano's* Addition to *Florio*, calls it *Carrato*, signifying, saith he, a weight or degree in *Metals, Diamonds, Rubies, &c.* and doth not determine it: but Mr. *Howel* in his ingenious *Tetraglotton* (sect. 40.) proportions it to the 24 part of an *ounce*, and Mr. *Webster* in his *History of Metals* speaks more clearly, and saith, the *Carrat* or *Charrat* is a term given (by the *Officers* of the *Mint*, and *Wardens* of *Goldsmiths*) to a certain composition of *Weights*, that are only used for *Assaying*, and computing the *standard* of *Gold*, and are of two *Contents*, namely, either the 24 part of an *ounce*, *Troy-weight*, and is compounded thus; of the pound *carrats* 2 d. weight, and 12 *grains, Troy*, make a *Carrat grain*, and 4 such *carrat grains* make one *carat*, which is half an *ounce*, or 10 d. weight *Troy*, and 24 of such *carats* make a *pound* or 12 *ounces Troy*, the other way of *Computation* is of an *ounce carat*, five *Troy grains* make one *carat grain*, and four of such *grains* make one *carat*, and 24 such *carats* make one *ounce Troy*, and  
for

for *assaying* he recommends the *ounce carat*, as more easy for *Calculation*, than the *pound carot*, which is made more perspicuous by our Author. *l. 2. c. 15.* See *Mony, Gold-weights.*

**CASE**, *T. Gebauesz*, or a little house, *L. Capsula. A. Case*, 'tis of various signification, as, a *Gramatical, Legal, Formal*, and sometimes put for an ill *chance* or hard *case*. See *Sculpture 1, 5, 12, 13.*

**CATSILVER**, *T. Kat-zon silver*, because it hath a grey *sparkling* colour like a *Cats-eye*.

**CEMENT**, *cementing* and *Cementation*. *T. Cemente-ne. L. Cæmentum*, not from *Cædo*; to beat (as *Minsbaw* would have it) but *Cæmentum*, is *quasi mens cæli*, i. e. the mind of *Heaven*, to *unite* things separated, especially, when they consist of one *species*, and it may well be observed in the vicissitude of the things in the *World*, that the whole *Labour* of *Man* and *Nature*, seems to be almost nothing else, but to *separate* what is *united*, and to *unite* things that are *separated*, and this not only seen in our *operations* upon *Metals*, but in the actions of *humane Affairs*: yet, to pass them by, this *Cementation* of *Metals* is properly a gradual *imbodying* or *uniting* of *Metals* first separated, and this by a *gentle* fire, as in *Lib. 1, 2, and 3 Books*, wherein there are several *magisterial Directions*: and in other *Cases* 'tis properly called a *Conglutination*, or *glewing* together. See *Conglutinate.*

**CENTNER**, *T. Center & Centner. L. centum*. At the *Mines* it signifies an *hundred* and *ten pounds* weight, but at the *Mint*, just an *hundred pound*: Whereby the *Miner* may get *10 l.* towards his charges: See *lib. 1. cap. 9.* but in *lib. 1. cap. 37.* and in many parts of the five *Books*, it is considered only as a small *Assay-weight* for trying how much a little *Part* of an *hundred weight* do hold of *Gold, Silver, &c.* whereby (as *ex ungue Leonis*, the whole *Proportion* of the *Lion* may be known from its *claw*: so by the small *Assay weight*, the goodnes of the whole piece may also be estimated, be it a *centner* or *half a centner, &c.* and this shews the skill of an *Assayer* in the skilful use of *Arithmetick*. CE-

CERUSE. T. *Bleywiesse*, L. *Cerussa*. A. *White Lead*, the best is made of *Lead*, calcined with the vapors of *Vinegar*; but the common way is by *Urine*.

CHRISTAL, T. *Keistal*, L. *Christalus* and *Christalum*, there is *Natural* and *Artificial*, the *Natural* is *Aqua quæ frigore in glaciem concrevit*; that is, congealed or petrified *Ice*. *Diodorus Sic.* and *Boetius* are of a contrary Opinion, and say, It is the purest *Earth*, dissolved by *Water*, and for want of *Water*, congeal'd to the *Christal-Stone*: 'tis found about the *Alps* and in many parts of *Germany*, *Hungary*, *France*, &c. And Captain *Ant. Langston*, my good Friend, who had travelled about 300 Miles into the Continent of *Virginia*, did assure me, that he saw there several Mountains of *clear and shining Christal*; he died about a year since, and was a very Credible person whilst he lived. Now the *Artificial Christals*, are made by *Chimistry*, and is a peculiar part of that Science, called *Christalization*; that is, making things like *Christals*: viz. *Christal of Silver*, *Tin*, *Antimony*, &c. See *Petrefaction and Stone*.

CHIMISTRY, see *Alchimy* and *Alchimist*: But I have something more to say to them, for I find that the *Chimist* hath another Name, and is called *Spagirus*; and *Chymistry*, *Ars Spagerica*; signifying, to *fine and refine Metals*, and therefore I have thought fit to put the words *Spagericæ Leges*, as the Title to this *whole Treatise*, instead of *Leges Chymicæ*, this latter being more commonly used than the other: nor do I wave the word *Alchimy* or *Alchimist*, because it is sometimes taken in an ill Sense, for in the best and truest Sence, by the addition of *ALL* (which word in all Languages signifies *Omnia*) so as by addition of *All*, we are to understand, That *Chymistry* doth comprehend *All Sciences and Mechanick Arts and Trades*, even from the *Coblers Awl* (T. *Aal*, and *Belgick Elsen*) to the *Astronomers Astralobe*, for nothing can be performed without some *Metallick Instrument*.

CINABAR, T. *Zenober*, or (l. 1. c. 2. f. 5.) *Bergennouer*,

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L.

L. *Cinnabaris*, which in *English* we call natural *Vermillion*, for of this *Cinnabar*, there are two sorts: *Natural*, which is an hard, red and heavy Stone, found in *Mines*: or *Artificial*, which is better coloured (made of *calcin'd Sulphur* and *Quick-silver*, which we now use with Metals) but it is vulgarly called *Ruddle* or *marken Stone*, and *Sinople* or *Red-Lead*; the first also of these two is *natural*, and the other *artificial*, but I conceive our *Author* intends none of these latter, but the former, or one of them. *Pliny*, *N. H. l. 23.* hath a large *Discourse* of this *Cinnabar*, and makes it the same with *Minium*, of a rich and fresh *Scarlet Colour*, and saith, there are whole *Mines* of it in some parts of *Spain*; and concludes with his *Opinion*, That it is the *Rust* of *Silver* and *Lead*, but it hath not the less *Esteem* with the best *Painters* or *Limners*, no more then hath *Verdigrise*, though it be the *Rust* of *Copper*: there is great quantity of this *Cinnabar* in the *Mines* of *America*, and some few *Veins* of it, in the *English Copper-Mines*. See *Gold* and *Quick-silver*.

CLAR, so the T. word is writ (*l. 1. c. 5. s. 1. and c. 7. s. 1. and c. 21.*) the *French* call it *clair*, and A. *clear*; Now though this word bears the same sense in all, yet because, by a certain composition, it doth *clear* the *Metals* and *Instruments* to which it is applyed (for distinction sake) I think fit, according to the T. to call it *Clar*, as a *substantive*, rather then *clear*, which for the most part is used as an *adjective*. viz. *clear Drink*, &c.

CLAY, T. *Laim* and *Thon*. *l. 2. c. 20. s. 1. &c.* But the L. calls *Clay* (which is of a flat and clammy Earth) *Argilla* and *Terra Figulina*, because *Potters* (by whom it is used) do reduce it to certain *Figures*; in A. it is commonly called *Potters-Earth*, or *Clay* for making of *Potts*, *Dishes*, &c. and although *Erckern* applyes the word chiefly to *Potters-Earth*, *clay* or *Loam*, yet there are many other *Clays* or *Earths* which have particular *Names*, according to their *natures* and *colours*; as *Fullers-Earth*, or *Clay* of a *Russet colour*, also *Blew*, *Green* and *reddish clay*, but that which is for common use is *solid* and *firm*, and for the most part of a *russet* or *blewish Hue* or *colour*.

and

and though it be said by *Minshaw*, That *Potters Clay* is called *Argilla*, from *Argos* a City in *Greece*, where *Potters* (as he saith) did first exercise that *Art* (which *Pliny* ascribes to *Corabus* an *Athenian*, one in the Province of *Argolis*, and the other in *Africa*, but both in *Greece*;) so it seems the *Art* was there, before it was in *Ægypt* in *Africa*: however, according to the Sacred Story, the *Art* of making *Pots* of *Clay* was antient, as we may read in *Exod.* 16. 13. and of *Bricks.* *Exod.* 5. 8. and in *Job* 4. 19. the *Houses* in his time were called *Houses of Clay*, and *Clay* was of such Esteem with *Jesus Christ*, That he made it an Instrumental cure in the *Blind Man.* *Jo.* 9. 6.

Now to pass these, In *Devonshire*, and other places, I have seen good *cottages* made only with *clay*, without any wood, except little *Window-cases*, *doors* and *roofs*; and in *Suffolk* and *Norfolk* the outside of most *cottages* and *out-houses* (to great edifices) are of *clay* daub'd on Splinters, and the insides also *plastered* with *clay*, and a little *Lime*, yet are very durable.

At *Woodford*, near *London* (about 20 years since) I saw a fair House of *Brick*, built on the top of that hill, and had no *lime* or other *mortar* within or without it, but found *clay* mixt with *sand*, which continues strong to this day, as I am informed: and in 1674. (my House in *Suffolk* (standing on an Hill, upon a *clay Soil*) I digg'd about 30 foot in length, and 10 foot deep, under part of it, with intent to make a *cellar*, designing to *pin* or *support* the sides with *Brick*: But finding the *clay* to be very firm (being matted and not spaded) and never before digg'd (as might be judg'd, because under the *clay* was found good *gravel*, and beds of flat *Oyster-shells*) I saved the charge by continuing the *clay* in stead of the *brick*, and I hear it doth hold firm to this day, as if it had been done with *Brick*: and doubtless, according as the *clay* is in goodness, so *Furnaces*, *Ovens*, *Tests*, *Crucibles*, &c. will the better indure the heat of *Fire* and *Metals*: care being taken that they  
be

be well dryed, after they are made, and before they be exposed to the fire, and then by degrees, and not suddenly burnt. See Brick, Earth, Loadstone.

COAGULATE, T. *Rensel*, L. *Coagulatio*, See conglutinate.

COAL, T. *Kollstein*, L. *Carbo*, of these we have Varieties, viz. *Wood-coal* (of several sorts mentioned by our Author) used chiefly for *Metals*, *Sea-coal* (dig'd out of *coal-Mines*, near the Sea at *Tinmouth*, by *Newcastle*, and *Pit-coal* (in Mines remote from the Sea) near *Coventry* in *Warwickshire*, and in *Staffordshire* and *Shropshire*, &c. but these are not useful to *Metals*: 'tis true, many have attempted to *Char* or make *Cinders* of them to be used for *Metals*, when *Wood* is scarce, but I have not yet heard of any certain success therein (though I wish it :) there is another *coal* which is artificial, which we call *Charcoal*, and I conceive the proper *Latin* word for it is *Anthrax*, and the burner of it *Anthratus*, but most *Dictionaries* do use *carbo* and *carbonis* for all sorts of *Coals*, by adding *Adjectives*, as *Carbonis Fossiles*, &c. but *Charcoal* being a new *Invention* (comparative to the other) it is fit to have a newer word than *Carbo*, and these *Charcoals* of *Wood*, are most useful for *Metals*: Now in making those of *Wood*, the *Art* is so much improved, that I have seen an *Arrow* with its *Feathers* exactly burnt into a *Charcoal*, without diminution of the *shape* or the *Feather*, only the *Feather* made black for white, and some of this *Wood Charcoal*, I have seen at the *Iron-Mills* in *Worcestershire*, so uncombustible, that they have come running out of the *Furnace*, and floated on the top of the *Metal*, whole and intire, and this (as they told me) was the *Charcoal* of the *Withy-Tree*, being a more light and soft *Wood* than any that grows in those parts: I carried away some of them, and cut them into fine *Pencils*, and used them for *Drawing*, on blew *Paper* (especially being first boyl'd in *Butter*) and the white *Pencils* proper to them, I made of *Tabacco-Pipe Earth*, in *Rolls* dry'd by the *Sun*, and not at the *Fire*, and sometimes I heightned the lights with *Ceruse* (composed of *Lead*, see *Ceruse*.)

C O W O R D S *Metallick.* C O

**COBOLT, T.** *Cobolt.* Sometimes accounted for the *Copper-stone*, and reckoned by *Dr. Salmon*, among the natural *Recrements* of *mettals*; and I do not find it by any other name, then as it is so described by *Erckern*. l. 1. c. 2. f. 11. & l. 3. c. 21. &c.

**COIN, T.** *Gemuntz*, the Latine hath several Words for it, *viz.* *Moneta*, *Nummus*, *Pecunia*, &c. and *Aurum*, *Argentum*, *Cuprum*, *Æs*; and antiently *Coriata* (when *Leather Coin* was currant and in esteem) but the proper word for it, (and so *Minshaw*) is *Cusus*, thence *Cudere* to *Coin*: Now *Moneta* is a relative Word to *Monere*, advising to take heed how to use *Mony*, only to honest ends, after it is once *Coin'd*: *Nummus* to *Numeratus* or *Quantity*: *Pecunia* to *Pecus* or *Sheep*, which were and still are commutative as *Money* it self, but it may be properly from the *Greek* Word *Kainos*, *Comunis*, because when it once had its *Stamp* or *Cude* upon it, then it was passable, currant and *Common*, and some would have it from the form of the *Coin*, consisting of *Angles* (as much of the *French* and *Spanish Mony* do) and some say, That from *Angular Coins*, the *Corners* or *Angles* of *Structures* are called *Coins*, because with such *Mony* the *Architects* were paid their *Wages*. Now, I conceive that I may add my *Supposition* also, That the Word *Coin*, may be the abstract of *Coynobeline* or *Cunobeline*, one of the *Kings* of the old *Britans*, and who is said to be the first that did *coin Mony*, at *Malden* in *Essex* (*Cambden*) where it is probable that their *Mines* (in our *Records*) since decayed or neglected, did supply him with *Metal*, for that purpose; however, in our later *Ages*, the Word *Coin* is still applied to *Metals*, formed into *Currant Mony* made of *Metals*.

**CONDENSE, T.** *Dick-Maken*, A. making *Thick*. L. *Condensatio*.

**CONGEAL, ver Breizon,** L. *Coagulatio*. See *Conglutinate*.

**CONGLUTINATE. T.** *Lime*, (from whence we have the word *lime*, for a *Dog* and *Bitch* in copulation) L. *conglutinare*.

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*glutinare*. *A.* to glew and join together : now these words *ce-ment*, *coagulate*, *condense*, *congeal* and *conglutinate* are often, but improperly, applyed to one sense, especially about *metals* ; for *cementing* is, as I have shewn in *Cement* ; *coagulation*, from *coagulo*, to *curdle*, i.e. where *metals* are joyned or *curdled* together by fire ; *condensation*, when *metals* are made more *hard*, or thickened ; *congelation*, when they are by Fire turned into a *Christaline*, *Glittering* and *Icy form*, from *gelare*, to turn into *Ice* ; which kind of *Christal* is often seen in *refining* of *metals* ; and *conglutination* from *Glutinare*, when they are joyned by a *glewish temper*, and is more properly applicable to vessels made of *Glutinous* matter, for the better holding of *Metals* in the Fire, yet all these Words still signify the making of things *thicker* or *harder*, than they were before : Now as to *conglutination*, I cannot here but call to mind what I saw at *Exmouth* in *Devonshire*, where upon little *Rocks* appearing somewhat above the *Sands* (at a low *Water*) there were *Oysters* sticking fast to them (which at an high *Water* were all covered by the *Sea*) so as we were forc't to beat them off with a *Chizel* and *Hammer*, and these they call'd *Rock Oysters*, the *Shells* being almost as firm as the *Rock* it self ; I confess I look't upon it as a wonderful *Secret* in *Nature*, That the *Oyster* could fix it self so firmly, having no outward parts to do it, and this in 12 hours time ; for at the next *Low-Water* those very *Rocks* (where at the former *Ebb* we had left no *Oysters* on them) they were filled again with other *Oysters*, and therefore it must be some *glutinous* matter, which they cast forth upon the *Rocks*, and so brood upon it to a *condensation* ; and I the rather believe this, because *Shell-Snails*, which we call *Dodmans*, have an excellent white *Cement*, always lying in the little end of the *Cone* of their *Shells*, with which they often glew themselves so fast to *Walls*, that they cannot get loose, but dye in their *Shells* : and so do's the *Limpet* (another *Shell-Fish* on the same *Coast*) cleave it self so hard to the *Rocks*, that nothing but a *Chizel* can divide them from the *Rocks* ; now  
cer-



certainly, if that part of the *Oyster-shell* which is so *glewed*, were mixt with so much of the *Rock*, on which it is fixt, there might be made a very *binding Glew* or *cement*, for *Metallick Vessels*; but there is another sort of *Shell-Fish*, upon that *Coast* also, which I cannot but mention, because I do not find it amongst those that write of *shell-Fishes*, and it is called in that *County*, the *Long-Fish*, or *capa Longa*, the longest are not above 12 Inches and about an Inch in breadth, opening at each end, and contains in it a *white-Worm* (for I cannot call it otherwise) which is a very nourishing Food, and being pickled up, are sent as acceptable Presents, to those that make their Gusts their delights; these are caught in this manner: at a *Low Water*, that is, when the Sands are clear of Water, those Fishes do shew themselves above the Sands, about 3 Inches, so as 8 or 9 Inches remain in the sands, and then those who make it their Trade to get them, presently go against the wind very softly (as in catching of *Moles*) and with an Iron Engine (somewhat like a *Spade*) strike under them, and so are caught; but if they go with the wind, the Fish presently retires into the Sand, without possibility of being caught for that Tyde, and though after their Escapes, I have seen them digg'd for, yet they vanish beyond the strength or agility of labour to catch them.

Now, these having no outward thing discernable to assist them in so quick a Motion, I conceive it must be by some glutinous matter, (such as we see do attend snails in their motion, but the snails cannot contract it again, because it usually lies on some dry substance) but the glutinous matter of these *capa longa's*, being fixt in their Repositories (much under the *superficies* of the sand, and so extended by them like a *spiders thred*) may with much more agility than a *spider* rise or fall as they please in a moment, there being a liquidity from their Repositories to make their motions of ascention or descention more agile and passable: Now from Creatures of this constitutions, certainly many excellent *Cements* may be made, as may be judged by the Fish, which *Pliny lib. 32. cap. 7.* calls  
*Itch-*

*Ichthiocalla*, and we *Ising-glass* Fish, which besides other virtues, the skin and other parts of it (as he tells us, and now we know by Experience) do make an excellent *Cement* (especially if it be mingled with *aqua vita*) either for earthen Ware or Metals: enduring both *fire* and *water*.

COLOUR, T. *Farb*. L. *Color*. A. *Colour*. (signifying *Beauty* or *Pulchritude*) of which there are two sorts: *natural* and *artificial*; wherewith the *Limners* and *Painters*, in Imitation of the *Beauty* of *Nature*, shews us the *Beauty* of their *Art*; yet they cannot perform their *Works* without the help and mixture of other *Substances*; as *Oyls*, *Gums*, &c. but their best and most proper *Colours* are from *Metals*; Whereof *seven* are accounted the chief, produced from the *seven chief Metals* which are influenced from the *seven Planets*, and these 7 *Colours* are used in *painting*, by two sorts of eminent *Artists* in that Science, *viz.* those who use them with *Gum* (call'd the *Art of Miniature* or drawing in little) and those which use them with *Oyl* (called *Limners* or *Painters*, or drawing in great and little) for I meddle not with those who work with *Pastils* or in *Frisko*; or *Dyers*, or *Tincturists*, so the first of these in an *Alphabetical Order* is *Black*; otherwise *White* and *Black* are accounted the *Principes Colorum*, & *Mensura Reliquorum* (Alsted.) And all of them produc'd from *Metals* and *Minerals*: the *Seven* are these;

I. BLACK, T. *Schwartz* (l. i. p. 6.) from whence we have our word *swarth* or *swarthy*, inclining to *black*) L. *Niger*. *Plutarch* calls it *color umbrosus*. A. *Black*, and these *Blacks* are natural in *Stones*, *Coals*, &c. but the best *Artificial ones* are made by the *retortions* of *Lamps*, placed under *Plates* of *Gold*, *Silver*, *Copper*, *Lead*, *Tin* or *Iron*, and are easily distinguish't, in their *nigerities* or *blackness*; and this shews, that *black* hath some superiority over *white*, because when *white* things, as *Ivory*, &c. are burnt, they turn to a *black*: but as to our purpose: it is *Observable*, That all these

*Blacks*

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*Blacks* are still heightned and improved for use, by the three eminent *Minerals*, viz. *Vitriol*, *Allum* and *Copperas*.

II. BLEW, T. *Blau* and *Himmel Blau* (in *English* heavenly Blew) the *Latines* renders it to us mostly by *Participles* or *Adjectives*, as *Lividus*, *Adluens*, *Ceruleus*, *Cyanæus*, *Cumatilis*, *Cœlestis Color*; that is, a Colour having those properties or resemblances: the *French* calls it *Bleu* and *Azur*, and we *Blew* and *Azure*, we from them, or they from us; which latter is the more likely, because we have more *Mines* of *Copper*, from whence it is produced, than they: now besides this *Azure Blew*, there is *Blew Bise*, *Ultramarine*, *Smalt*, *Flory*, *Inde-Bandias*, *Litmus*, *Orchal*, *Blew Vitriol*, *Verdigrease*, produced from *Mines* and *Minerals*.

III. BROWN (or *Russet*) T. *Braun*, the *Latines*, which would bring this into the *septinary* of colours, call it *color natus* and *Pulligo* (*Holioke*) otherwise the common name is *Fuscus*, from the darkness of its colour, being (as it were) an attendant on *Black*, and of this *brown colour* (which is the proper colour of *Tin* and *Copper Oar*) there is *Umber*, *Spanish-Brown*, *Terra d'colonia*, *Turnsil*, *Bole Armoniack*, and other products of *Metals* and *Minerals*, which *Painters* and other do use for it.

IV. GREEN, T. *Gruen*, L. *Veridis Recens*, and many other words relating to the diversity of *Greens*, but those which are used for *Painting* (from *Metals* and *Minerals*) are *Green Bise*, *Virditer*, *Verdigrease* (which though it be used for *Blew*) yet being steeped in *Vinegar* (as I have oft tryed) it doth produce a delightful transparent *Green*: also *Copperas*, *Vitriol* and *Allum* do much improve this colour.

V. RED, T. *Rot*, L. *Ruber*, *Rufus*, &c. to supply which for *Painting* (there is *Lake*, which is another delicate transparent red purple colour) also *red Lead*, *Vermillion*, *Cinnabar*, *Minium* (of different Names, yet little differing in colour)

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also

also *Cinople*, *Rosset*, and several other *Reds* from *Metals* and *Minerals*.

VI. WHITE, T. *Weitz* and *Blanck*, L. *Albus* and *Candidus*, to represent this, the *Painters* use *Littarge* of *Silver*, *Ceruse*, *white Lead*, *Spanish White*, &c. raised from the *Calcination* of *Metals*.

VII. YELLOW, T. *Gelb*, L. *Gilvus*, *Flavus*, *Fulvus*, *Luteus*, *Crocens*; to represent this, they use *Littarge* of *Gold* (and a liquid matter which counterfeit *Gold*, such as is used about *Coaches*, &c.) they have also *yellow Orpiment*, *sandarach*, *Masticot*, *yellow Oker*, &c.

Now of these *colours*, those which are produced from *Metals* and *Minerals* (as I have shewn) are too *piercing* for *Paintings* with *Gum*, and therefore not *lasting*, but with *Oyl* they are *safe* and very *durable*, even to a *thousand* years or more, especially in the curious *Art* of *Anealing*.

Now concerning *colours* in general, here is the difference between the *Botanick Science* and the *Metallick*, because in one the *colour* of *Plants* are seen, in their admirable *variety*, without the use of *Art*; but the *colours* of *Metals* are not seen, but by the help of *Art*; only it may be supposed, that every *Vein* of *Metal* hath some *pretious Stones* to attend it, whereby we may be informed of what *colour* that *Metal* is most apt to yeild by *Art*: as *Saphires*, *white* and *yellow*, *Diamonds*, *Rubyes*, *Emeralds*, *Amathists*, &c. which are daily found (especially in hotter *climates*) there are also other *colours*, mentioned by *Erckern*, as *grey Lazure*, *red Sulphur*, *Purple*, *Orange*, &c. but whoever will make a more exact *review*, will find, that the most *pleasing*, *useful* and *durable colours*, are from the *Metals* themselves, or their *Extracts* and *Flowers*, seen in their *Original* representatives, viz. *Gems* and *pretious Stones*.

CO-OPERATE. T. *mit eyn ander werk*. L. *Co-operate*, to work together, that is, when *Metals* do work together before separation, and is also generally applyed to any *joynt* action.

COPELLS.      See Utenfils.

COPPER, T. *Cupfer*, L. *Cuprum* (l. 3.) A. *Copper*, and is accounted the third Metal in esteem next *Gold*; and, as is pretended comes from the Isle of *Cyprus*, from whence it had its Name *Cuprum*; we need not go so far for it, having many Mines of that Metal, both in *England* and *Wales*, especially those at *Keswick* in *Cumberland*, which occasioned a great *Suit* between *Queen Elisabeth* and the *Earl of Northumberland*, concerning her Right to them, upon the account of *Royal Mines*: which Case is reported by *Plouden*, with the Opinion of the Judges on the Queens side, wherby the *Society for the Mines Royal*, have had and still have the care over them, but for want of *Fuel* and skilful *Miners*, they are of no use at present: This Metal is of three sorts, the *Red* or *Reddish* is the proper *Natural Copper*: *Yellow Copper*, which, for distinction, is properly called *Brass*, is an *Imitator* of *Gold*: the *White* is when *Copper* is tinged with *Silver*, so as it imitates *Silver*.      See *Brass*.

COPPERAS, T. *Vitriol*, L. *Vitriolum*, this is a kind of Stone which is cast up very plentifully between *Rochester* and the *Isle of Shepy* (which being not far) I went purposely to the *Copperas-Works*, farmed of *Mr. Haward* (Lord of the Soyl) by one *Mr. Johnson* a *Londoner*, who in few years got above 20000 *l.* by it, as appeared by what he left to his two Daughters, when he died: I went also to other places, but did not find that the Stones are so plentiful and good in any other place of *England*: it is of a dark *Sea-Green*, but being melted its colour is heightned, and glitters like to *Chrystal*, and serves for many uses about Metals, and almost in all *Trades* where colours are concerned, and is one of the chief Ingredients for good *Ink*, as I found it in an old *Abbot's Book*:

*Vitrioli quarta mediata fit uncia gummi*

*Uncia fit Galli his jungas octo Falerni;* (which I take to be Sherry)

*His bene contritis comixtis omnibus illis*

*Facit bonum Atramentum.*

And

And therefore this *Copperas* or one sort of *Vitriol* (in distinction of the white (called *Dans Vitriol*, because from *Danemark*) and the perfect *blew Vitriol* (called *Roman*, coming out of *Italy*) is called *Atramentum Sutorium*, because *Shoemakers-black* is made with it. See *Colours, Black and Vitriol*.

**COPPER-stone**, T. *Ruffer stein* (lib. 3.) is no other than solid *Oar* of *Copper*, as it is in the *mine*, and not touch'd by other *Imbracers*, or, as it is made at the first *smelting* into *Cakes* or *stones*, and so the word *Stone* is commonly applyed to it by *Erckern*. See *Oars and Stones*.

**CRISTAL**, See *Christal*.

**CROCUS**, is the T. and L. for *Saffron* (lib. 2. and 4.) but in *Metallicks*, it is meant a powder made of *Iron* or *Antimony*, of a *Saffron colour*, and when it is made of *Iron* it is called *Crocus Martis*, or of *Copper*, *Crocus Veneris*, because it is the powder of those *Metals* of *Iron* and *Copper*, which are Dedicated to the *Planets Mars* and *Venus*, and sometimes is made of *mixt Metals*, and then called *Crocus Metallorum*, and are often mentioned by our *Author*.

**CREIZER** (l. 2. c. 2.) T. *Kreutzer* from *Kreutz*, or a little *Cross* stamp'd upon it, and is so small a piece, that it is accounted but the 92 part of an *Hungarian Gilder*, which is about 30 pence of our *Silver*: but *H. Vaughan* in his *Book of Coinage*, makes six sorts besides the *Hungarian*. See *VVeight*.

**CRUCIBLE**, T. *Tiegel*, I find no proper *Latine Word* for it, but it may go under the word *Phiala* for a *Cruise* or a *Pot*, and this *Crucible* is a diminutive of *Cruise*, or *Pot* less than a *Cruise*, but of different shapes: and this is used for dissolving of small pieces of *Metal* for *Assaying*, as others are for other uses called *Cruises*. See *Pots*.

**CULB**, T. *Krug*, which is a common name for all *Cubical Pots*, but we call it *Culb*, from the particular form of it, I suppose, because it inclines to a *Cubical* shape. See *Sculpture*.

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**D**EAD, T. *Todt, Todter* (from whence we have our word *Tclod* or *Clod*) and *Gesterben*, L. *Mortuus, Defunctus*. See Dissolution.

DECLINATION, T. *Nidersichbiegn*, L. *Deorsum se fletere*, and is almost the same with *Precipitation*; for which *Gramarians* use the Word *Declination, Declension*, or going from one *Case* to another, and in the *Vulgar* sence, a man is said to *decline* in his *Fortune*, when he falls from *Prosperity* to *Adversity*: but in the *Metallick* sence, it is to fall from the *top* to the *bottom*, by which means the *Metal* is better than when it was at the *top*; and 'tis often seen that *adversity* makes Men better and of more use (as *Metals* are) by being *Cast down*; a *Pbraise* often used in this Book. See *Precipitation*.

DEFT, (l. 1. &c.) an *English Saxon Word*, therefore I retain it; signifying *fair, clean, neat* (*quasi sine defectu*) or without defect, on the contrary *undeft* is *unclean*, &c. (*Skinner*.)

DELINEATE (l. 2.) or to *Describe* a thing by certain *Lines* or *Figures*.

DIAMETER (l. 1.) is a certain straight *Line*, drawn through the *Center* of a *Figure*, and of both sides bounded in the compass of it, cutting or dividing the *Figure* into two equal parts.

DISHES (l. 1. &c.) T. *Schueffels*, L. *Discus*, A. *Dishes*, and these are of various sorts and shapes, but the most useful about

*Metals* are made of *Pewter*, *Iron* or *Clay*, for I do not here write of *Epicurean Dishes*, but of *Dishes* or *Bowls* that are certain *measures* in *Mines*, which are filled with *Oar*, by the Labour of the *Miners*, whereof a certain number are paid as a *duty* to the *King*, others as a *duty* to the *Church*, and the rest to the *Proprietors*, and according to the number of *Dishes* delivered, so the *Miners* are paid; and then they may eat the *Fruit* of their *Labour* in other *Dishes*. See *Utenfils* and *VVardens*.

**DISSOLVING** (*l. 2. &c.*) that is, a *metal* easy to be loosed from such other *metals* as are fixt or intermixt; and thence *Death* is called a *Dissolution*, when the *Soul* is loosened from its *Terrestrial part*, and becomes a *Cælestial Metal*, and from hence the word *Dead* is oft used in *Erckern*.

**DISTILLATION** (*l. 2. &c.*) is a drawing of a *Liquor* made thin with *heat*, into a *Receiver*, by *Alembicks*, *Retorts*, &c. and is mentioned by our *Author*, though of little use to *Refiners*, who deal with hotter *fires* and harder *substances*.

**DRAGGONS-BLOOD**, *L. Sanguis Draconis* (*l. 2. c. 13.*) our *Author* useth it for *Lutings*. *Dr. Salmon* saith, It is the product of a *Tree*, red like *Blood*, or the colour of a *Dragon*, and comes to us from *America*, and by boyling condensed: but *Pliny* (*l. 26. c. 7.*) saith, That the *Indians* make it of the *substance* of a *Dragon*, crush't and squiezd with the weight of an *Elephant*, falling upon a *Dragon*, that hath suck't him to *Death*, whereby the *Dragons* and *Elephants Blood* are mingled together; and of this the *Indians* make a *Colour* like *Cinnabar*, so as though they bear one name, they are of different *Natures*, and which it is that *Erckern* means, I leave it to others; for the *Blood* of the *Ox*, &c. we see in other of his *Experiments* is used in *Luting* and *Cements*: there is also an *Herb* growing plentifully in *England*, called *Dragons Blood*, which is much used to *tinge Colours*, and hath a *Restricting quality*, and so may be used with *Clay* in *Lutings*.

**DRAM** (*l. 1. &c.*) *T. Quintlein*, *L. Drachma*. see *VVeight*.

DREGS,



D R      W O R D S *Metallick.*      D U

**DREGS,** *T. Trussen vapsen, L. Fax,* from whence we use the Word *Feces.*

**DRIVE** or *Driving, T. Abtreiben, L. Abigere, Depellere.* l. 3. c. 25.) signifieth the forcing of *metal* to cast its *dross* upwards, as the *feces* downwards, l. 3. c. 25. & 26. and in many other places used.

**DROSS.** *T. Treusen. L. Fax. A. the scum of metals:* see *Dreggs, Feces, Scorias, Lees, Slacks,* &c. so it seems *Dreggs* is the *purge* or *settlement* at the bottom of *melted Metals,* and *Dross* the *vomiting* the *crude matter upwards.*

**DRY,** *T. Abdoerren and Treigen maken, L. Siccare* (l. 3. c. 26.) see *Ovens.*

**DUCCATES.** See *Money.*

**DUKE-GOLD.** See *Money.*

**DULCIFICATION,** *T. Susz, L. Dulcis,* or *reducing* the ill *Tasts* or *Scents* of *Metal* to *sweet* and *pleasing;* and thence the *Pouder*s often are called both *Sugars* and *Salts,* as they are different by *Extraction,* and the *perfuming* of them called *Hedichra,* and these are dispersed in our *Author,* and are called *sacharia Auri,* or the *Sugar of Gold.*

**DUNG,** *T. Tingen, L. Sturcus,* and of these *Horse* *Dung* and *Ox-Dung,* and some other *Dungs* are a chief *Ingredient* to *Lutings* (used by our *Author* l. 2. c. 20. &c.) and the *Dung* of *Creatures* are not only used in this *Art,* but in almost all other *Arts* and *Sciences;* by *Chimists* called *Ignis Sapientum,* or the *Wise-man's Fire* (*Howel*) and though it be in contempt amongst *Ladies* (and the less *Learned* *Inquirers* into *Nature*) yet certainly the *Heathens* had them in such *Veneration,* that they *Sacrificed* to most of their *Idol Gods,* upon the account of *Stercorary* *Virtues* in them: and therefore the *Translators* of our *Bible* into *Latine,* instead of *Idols* calls them *Dij Stercorarij* (*Junius* and *Trem.*) of which I apprehend this reason: *viz.* that the several uses which they made of *Dung,* either for *Medicine* or *Manuring* their grounds, might be *propitious* to them: and I have read it from some *Traveller* of note, That among  
the

the *Indians* it was usual, . that when they intended *Homage* to their *Superiors*, or *welcome* to their *Friends*, they did *evacuate* their *Dung* into their *Hand*, and so daub it on the *Face* of whom they intended to *honour* or *pleasure*, and was ever accepted by them, as the *first* and *best* of their *Welcoming Ceremonies*: for *Agricola* tells us of *Mans-Dung* made as sweet as *Civvit*. But to return nearer home, when I remained in *London*, during the great *Plague* in 1666. *Dr. Glisson* (famous in his time) being my old *Friend* and *Acquaintance*, perswaded me to take a piece of his constant *Antidote*, which was only the *Dung* of one that had dyed of the *Plague*, dryed, and so kept in a *foraminous Box*, for the best *Antidotical Perfume*; but I thank God I escaped without it: and let us but consider of the great *Virtue* of the *Dung* of *Geese*, *Ducks*, *Peacocks*, *Dogs* (generally known and used) it were worth the while to make a *Collection* of them, from *Johnson's Natural History of Quadrupedes*, &c. and it may very well compleat a large *Book* of those useful *Experiments*; especially if a little variety from *Pliny* be admitted: so I will conclude with this *Direction*, That *Stone-Horse-Dung* is of certain and known *Virtues* in *curing scaldings*, *scorchings* or *burnings* by hot *Metals*, if quickly applied to the part grieved.

**DUCCATE**, T. *Ducat*. L. *ducalis aureus*. A certain *Gold coin* which was first coyn'd in *Rome*, Anno 547. and afterwards it began to be used in other *Places*, and so called because it had the *Image* of a *Duke* (that is, some eminent *Leader* of an *Army*, à *ducendo*) and worth about 6 s. 8d. *English*, now 9 s. (*Holiock*) This *Coyn* was held formerly the best *Gold*, but now it is much *adulterated*, so as *Goldsmiths* are very careful in receiving them.

**DUST**. T. *Staub*. L. *Pulvis*. See *Ponder*, *Asbes*, *Pulverising*.

E A



E A

**E**ARTH, T. *Erd*, L. *Terra*. A. *Earth*, from the *Saxon*:  
 Now, in every *Territory* there are differences of *Earth*,  
 so there are accounted *sixty eight sorts*: but of those  
 which are esteemed the best in *England* (which other *Nati-*  
*ons* make use of more than our selves.) some of them are ra-  
 ther *lapidious* than *fragile*, as *yellow Oker* (of which I have  
 seen a *Pit* or *Quarry* in Mr. *Whorewood's* grounds at *Hal-*  
*ton* in *Oxford-shire*;) also *red Oker* (which some call *Marking-*  
*stone*) in many places, and both of these are improved by  
*artificial Okers*: and of *Fullers Earth* there is store, and ve-  
 ry good, in a *Lordship* of the *Earl of Bedford's*, near *Oburn-*  
*Abby*; also in Sir *John War<sup>nets</sup>* ground in *Suffolk*, and in  
 many other parts of *England*; (of which the *Dutch* make good  
 use, though there is a *Law* to the contrary.) As for *chalk*  
 which is burnt into *Lime*, and *White Earth* for *Dishes*, there  
 is very good in a *Mannor* of the *Lord of Abergaveny's*, near  
*Norwich*, in *Norfolk*, and *Potters-Clay* for *Pots*, and *Marl*  
 in most *Counties*, with which they manure and much improve  
 their *Grounds*; also earth for making *Brick* and *Tile* for *Hou-*  
*ses*, &c. of which there is plenty in most *Counties*, and com-  
 monly they burn to a *red Colour*: but there is a sort of *Brick-*  
*Earth* in many parts of *Suffolk* and *Norfolk*, and in other  
*Counties*, which burn *white*, and are more lasting and dura-  
 ble than the *red*, and these, other *Countries* borrows from us;  
 and we borrow from them the *Terra sigillata*, *Terra Lemnia*  
 and *Terra Armenia*, and many more of great use and *Virtue*:

[N]

but

but that which is common to us all, is *Sand*, and this is particularly used for those *Ovens* which are called *sand-Ovens*, *Sculpture* II. and XXIV. for separating *Metals*: Now these have their several Names and Natures, as *Pit-Sand*, *drift-Sand*, *Sea-Sand*, &c. which may be experimented in *Chimical Operations*, viz. what kind of *Sand* is most proper for *Metals*, and what for *Mortar*, &c. But before I pass this Discourse, I cannot but speak of the *Sands* at *Icklingham* in *Suffolk* (yet spreading into *Norfolk*) having their rise from an *Hole* in that *Village*, therefore they are called *Icklingham-Sands*, or rather *Mowing's Sands*, but their Motion is different from all others, for these do not move but by a *Western Wind*, and then they go *East*, and lie still and compact in any other *Wind*, and yet it hath walk'd from thence above Eight Miles to *Brandon* and *Downham*, two Towns *East* of it, covering the ground at least a foot deep for more than a Mile in breadth; and whilst the ground is so covered it produceth not the least sprig of any green thing: Now *Brandon* and *Downham* are two Towns situate on *Suffolk-side*, by the edge of the river *Ouse*, which runs from *Thetford* to *Lyn-Regis*: and the Inhabitants did make very high Banks to defend their *Meadows*, and to prevent the stopping up of the *River*, so that you might see good Meadow-ground on the *East-side* of the Bank, worth 20 s. an Acre; and on the *West-side*, sandy ground, the Inheritance not worth two pence an Acre to be sold. But the Inhabitants being not able to defend their *River* or *Meadows* any longer, left the *Sands* to act their pleasure: and then they fairly march'd over the *River*, and are gone about three miles into *Norfolk*, still keeping the same point of motion. Now, whether this proceeds from any extraordinary attraction of the Sun, or inclination of the *Sands* to the *Sea-shoar*, by way of sympathy, being about twenty miles *East-ward*, I shall leave it to further Consideration: and my reason of writing this was, that in *sand-Ovens* for *Metals* the different sorts might be tryed, some being of a very *fresh*, and some of a very *salt*, and others of a very dry Nature.

And

And I cannot but further observe, that the *Western* parts do as much admire at the *Eastern* sandy Grounds producing pregnant Crops, as we at their mountainous Crops, both having their *Fertility* from the artificial and laborious *Mixtures* of other *Earths*, with their *stones* and *sands* : see Sculpture **XLI.**  
*Clay, Sand, &c.*

EGG, T. Eye. L. *Ovum*: l. 1. p. 20. this word hath as much difference in our Neighbouring Languages as any I meet with, and therefore I shall set them down; the *Greeks* call it *Ooen* : the *Saxons*, *Egbe* : the *Belgick*, *Eye* ; like the *Teut*, the *French*, *Oeuf* : the *Italian*, *Novo* : the *Spanish*, *Huevo*, &c.

In the *Egg* there are three parts, the *white*, the *yolk* and the *treddle* ; the *white* of an *Egg* is called in L. *Albumen*, T. *Eyeclar*, and by *Pliny*, *Ovi Albus Liquor*, and this is called *Eye clar*, from the bright spots in it, by whose delatation the *Coliquamentum*, which is made from it, is stiled (by that Learned Dr. *Harvy*,) the *Oculus* or *Eye* of the *Egg*, agreeable to the *German* word *Eye* ; the *Yolk* is called in T. *Totter*, L. *Vitellus*, from *Vita* ; the *Treddle* is called *Chalaze*.

There is little use in Metallick matters of the *Yolk* or *Chalaze*, but our *Author* often mentions the use of the *white* of *Eggs*, as a chief Ingredient for *Lutings*.

But upon this occasion of writing of *Eggs*, I am put in mind of a *Camelion*, which was bestowed on me by Mr. *Fasset* (an Eminent and Honest Chyrurgion) which was sent him out of the *East Indies*, and with it the very *Stalk* and *Cluster* of small *Eggs*, as they were in the *Body*, and one *Egg* in its full proportion, as *white* as *Pullets Eggs*, and as big, considering the proportion : this *Egg* from the *Camelion* was a perfect round shell, whereas *Hens* are *Oval*, so as I find this difference, that the *Camelions Eggs* are *Oval* within, and are cast out of the *Mouth round*, but *Hens* are round within and are cast out of the *Fundament Oval* ; and the reason may be, that the *Camelions Eggs* comes out of its *Throat* (the extention of which is of one constant *Globular form*;) and so *Snakes* and *Fish*  
(whose

(whose Eggs are round) do send them out of their Mouths, and then take them in again, as they perceive any *danger* to their *spawn* or *Eggs*; but *Hens Eggs* come out of an *Orifice*, which opens by degrees, which makes the first part of the *Egg narrow* (for the little end comes ever first) and so the passage extending gently, the pliable *Egg* encreaseth in bigness, and at the exclusion doth narrow it again, but not so much as at the first egress.

Now it is to be observed, That when the *Egg* is unloosned from the *Knot* or *Cluster* of the little *round Eggs*, it soon receives extention into an *Oval form*, even whilst it remains in the *Body*, in compliance to its passage through the *Fundament*; and whilst it is in the *Body*, it is prepared also with a *white Film* over the whole *Egg*, resembling, but is not a *shell*, because it must endure *compressure*, and being now *ripe* to be *expulsed*, then by a certain *spirituous liquid Cementation*, or glutinous *varnish* from its *Dung* (which passeth out with it) and by the *ambient Air* (at its coming out) it is crushed in an Instant into a *solid shell*, which will not endure *compression*: And this I mention the rather, because I find that the Learned *Dr. Harvey* attributes the hardness of the *shell* to the approaching *Air*, and not to the *Cementing Dung*, and doth not in the least Discourse of the causes of *oval* and *round forms* of *Eggs*.

ELECTUARY, of which there are near an hundred mentioned in the *New London Dispensatory*, whereof the chief are from *Metals* or *Minerals*.

ELIXAR is exalted Quintessences, made by *infusion* and *Digestion* of *Metals*, &c. whereof there are also 25 sorts in the aforesaid *New London Dispensatory*. the chief of them also are from *Metals*. See *Quintessence*.

ELL, T. *Elen* & *Eblen*, L. *Ulna*, *Cubitus*, A. *Ell*. Now it is here to be noted, that the English *Ell* is as long as two *German Ells*: and so it is to be applied proportionably to the making of *Furnaces*, &c. See *Finger*, *Hand*, *Measure*.

ENAMEL, See *Amel*.

EQUI-

E S            W O R D S   *Metallick.*            E X

EQUILIBRIO, See *Weights.*

ESSENCES, (Doct. *Salmon.*) are the *Balsamick* parts of *Metals*, or of any other thing clearly separated from their gross parts, whereof 16 are numbred in his *London Dispensatory*, and the chief of those from *Metals* or *Minerals*. See *Quintessence & Elixir.*

ESUSTUM, T. or *Copper* calcined and then called *Calx Veneris*. See *Products of Metals.*

EVAPORATION, and to *evaporate*, T. *Dampfflein*, or to take away the *Dampness* or *exhaling* of the humidous parts of *Metals*, by a gentle fire, or heat. (D. *Salmon*) L. *Evaporare*, or to take away *vapors*. See *Fumigation.*

EXPRESSION, T. *Ausz Trucken*, L. *Expremere*, i. e. a straining or drawing forth *Metals* or *Liquids* by pressing, and this done either with *Linnen* or *Leather*. See *Filtration*, and *Quick-silver*, the word is also applyed to the speaking fluently.

EXTERN. T. *Auszwendig*, L. *Externus*, or the outward part of *Metals*, or things.

EXTRACTION, T. *Ausz Zichen*, L. *Extractio* and *extrahere*, that is, the drawing the *Essence*, *life* or *vertue* out of any *Metal*, by a fit *Menstruum* or *Liquor* from *Oyl*, *Tartar*, *Calx viva*, *Vinegar*, &c. whereof above 60 are in *Dr. Salmon's New London Dispensatory*, and have peculiar names, *viz.* the Extraction from *Iron* is called *Crocus Martis*, and so of the rest.

[O]

FECES

F E



F I

**F**ECES, T. *Trusen*, L. *Fecula*, or certain setlings which remain at the bottom of *melted Metals*, which may be reduced to a profitable *Powder*; and we also call *faces* from *facere*, or that which is made to flow or float on the *top*, or sink to the *bottom* of *metals*; and the word *Dross*, seems to come from *Ros*, or *thick dew*, which ariseth from *Metals*, and condensed bodies: also the word *slacks* T. is *Slacken*, L. *Scorias*, which signifieth also *Dregs*; and these are so called before the *Metal* it self is by *Præcipitation* cleared from them; and it may be observ'd, that *Argol* (the *Dregs* of *Wine*) which is *faces* of another Nature, for it hath this Property, that as the *scum*, *dregs* or *faces* of *Metals* fly to the top or bottom, this betakes it self to the sides of *Vessels*, as if it scorn'd to be called either *Scum* or *Dreg*.

FERMENTATION, T. *Saurmachen*, L. *Ferment* or to *leaven*, *raise* or *improve*; but as to *Metals*, it is used for *rarification*, *ripening* or *flowring* them by addition of *Ingredients*, as our *Bread* is ripened by *Leaven*, and *Beer* is flowred by *Yeast*, and in many parts of our *Author* it is used: See *Dregs*, *Dross*, *Scoria's*, *Yest*, &c.

FILE, T. *Feile*, L. *Lima*, A. *File* or *Rasp*, to file *metals* to a *Powder*, and the *filings* are called *Limations*, but we use the word *File* in three other senses, viz. *File*, from *filum* *Thread*; a *File* of *Souldiers*; which may also come from *filum*, because they stand in a direct *Line*, like an extended piece of *Thread*.

FIL-



**FILTRATION**, also from *Filum* a *Thread*, because *Cloths* woven of *Thread*, are used for straining *Quick-silver*, &c. but that is more properly called *Expression* (as before) for this *Filtration* is done two ways, either by *brown Paper*, or *Pendent Lists* of *Cloth*, whereby the liquid *Water* may drop *guttatim*, from one *Vessel* into another. See *Expression*.]

**FINGER**, T. *Finger*. See *Measure*.

**FINING**, *Refining* and *Clarifying*, T. *Saenberung* and *Reinguns*, L. *Purgare*, *Mundare*, and are only the making the *Metals* more perfect in their *Species* or *Kinds*, by often melting them from their *Dross* or *Dregs*, l. 1. p. 18.

**FIRE**, T. *Fewr*, L. *Ignis*, is the chief *Operator* in the *Dissolving* of *Metals*, still shewing its power and activity on the *sulphurous* part of *Metals*, and makes it fly away or submit.

**FISH-BONE**, T. *Fisck bein*, L. *Os piscis*. See *Bone-Ashes*.

**FIST**. T. *Tauf*. L. *Pugnis*. See *Measures*.

**FIXATION**, to *Fixt*. T. *Hesten*. L. *Figere*, is the making of that which is *volatile* in *Metals* to be *Fixt* and endure the fire, and not fly away; and this is done by *sublimation*, still adding some *fixt Metals*; as *Lead-Glass*, *Lead*, &c to the *Volatile*.

**FLAME**, T. *Flam*, L. *Flamma*, or the *Oily* part of *Wood*, or *combustibles*, impregnated by fire, for the more easy passing it self into all the porous parts of *Metals*.

**FLEAKY**, *Flakes*, *flaky*, T. *Floken*, L. *Floccus*, *Fragmen* and *Strictura*, A. *Flaky*. See *Shivery* and *Shivers*.

**FLEGM**, T. *Rhoden*, L. *Flegma*, *Pituita*, or the *waterish*, *volatile* and *unfixt* part of *Metals*, and as in *Man* it is of a thicker substance than *spittle*, so in *Metals* it is of a thinner than the *Scoria's* or *Dross*, and that which ariseth from *Sulphur* or *Vitriol*, is commonly *acid*, *sharp* and *salt*.

**FLINTS**, T. *Fewerstein*, and sometimes in the T. they are called *Hornstein*, from the colour: L. *Silix*, there are such store of these in *Norfolk* that it makes a *City* in *Spain*

accounted one of the *wonders* of the *World*, being encompassed with fire, that is *Flints*, to be no wonder: but the *Metallick Flints* are such as accompany the *Veins* of *Metal*, and from whence *Metal* is made; but whether the *Norfolk Flints*, though full of *Ignituous matter*, will afford the like, may be tryed, by such as do not value the charge of *Experiments*; and then the great *Labour* and *Expence* of digging in *Mines* might be saved. l. 1. p. 7. &c. See *Stones*.

**FLOCKS** (of *Wooll*) L. *Floccus*, the same with *Flakes*, *Flocks* of *Wooll*, T. *Ein Loken Wull* (l. 2. c. 20.) and *A.* called *Locks* of *Wooll*, by lastly using *l* for *f*, for it hath its name from a *number* of *Sheep* which bears the *Wooll*, which makes *Flocks* (being the remnants of the *Wooll* after *Combing* and *Dressing* it) for spinning; the like is made of the remnants of *Flax* after *Dressing*, called *Hards*, and both of these are much used for *Lutings*, and it may be a *Quere*, whether the *Flocks* of *Lemster Wooll*, which is the finest in all *England*, or *Norfolk Wooll* the worst, be the best for use? but I prefer *Leimster Flocks*, because its *Wooll* is called *Leimster Oar*, oftner than *Leimster Wooll*, because the feed of the *Sheep* consists of those *Herbs* and *Plants* which have their *Virtue* from the *metallick Oars* under them; so as I know, that the *Sheep* of *Leimster*, being removed to places where there are not such *subterranean Oars*, their *Wooll* in one year will be adulterated by their *Feed*, the word *Flocks* is also *metaphorically* used for *Societys* of *Men*, and *Beasts* or *Birds*, &c. l. 1. p. 9. &c.

**FLOWERS.** L. *Flores*. T. *Blum*, from whence we have our *Word Blossom*; this word in natural *Plants* signifies such parts, as are extracted by the *Sun* into delicate *shapes* and *colours*, and as they are the last *Works* of *Nature* upon *Plants*, so that which *Chymists* calls, *Floss Auri* (or of any other *Metal*) is, as it were, the last *sublimation* or *extraction* by *fire* from any *Metal*; and as the *Flowers* of *Plants* have their *vertues* superior to all the other parts, as *leaves*, *stalks*, &c. so the *Flowers* of *Metals*, which some also call *Pouders*, are superior to the  
Gold,

Gold, Silver, or any Metal in their substantial *Bulks*, or *multi-*  
*farious* ways of *Extracts* or *Magisteries*.

FLUS, *T. Fluez*, I retain the Word *Flus*, because it comes  
from the *L. fluere* to *flow*, as that which is *fluid* or *flowable*, and  
and sometimes (as it is a *Composition* of the *Glass* of *Lead*)  
it is called *Lead-Glass*, which being put into *dissolvable metal*,  
it gives expedition to their *Dissolutions* (*l. 1. c. 8. c. 26. fo*  
*l. 2. c. 5. &c.*) and from hence may come the Word  
*flushing* or *flowing* of the *Blood* to the *Face*, from other  
parts, &c.

FORCEPS. *T. Tangs. L. Forceps. A. Tongs.* See *Utenfils*.

FORGE. *T. Einschuide. L. Fabrica.* See *Utenfils*.

FORREIGN. See *Outlandish*.

FORMS *Chimical.* See *Salt*.

FRESH, *T. Frisch, L. Recens.* See *Oars*.

FUMIGATION, from *L. Fumus, A. Smoak, T. Rauch*,  
but as to *Metals* it is used when they send up *sharp* and *sti-*  
*fling Spirits*: see *Evaporation*, but note that *Fumigation* is ap-  
plied to *dry bodies*; *Evaporation* to *liquid*, to shew the dif-  
ference between *Fumes* and *Smoaks*.

FUNNEL. See *Utenfils*.

FURNACE, See *Utenfils and Ovens*.

FUSION, *T. Geissig*; the *Word* is oft used by our *An-*  
*thor*, and by *Metallists*, but more by *Distillers*; sometimes  
signifying putting in; from *infundere* and *fundere*, and some-  
times in *metals* called *fusile* or *fusible*, being so meltable as it  
may be poured in or out.

G A



G A

**G**AMAHEZ, is an *Arabick Word*, signifying the *Figures* of things (as of *Birds, Beasts, Snakes, Trees, &c.*) naturally represented in or upon *Stones*, which usually attend *Mines*, as other transparent *precious STONES* do, as I have shewn under the words *COLOURS* and *YELLOW*; for I intend not here to speak of *Talismanical Figures* from *Constellations*, for which I refer you to *Gasserel, G. Agricola, &c.* But first of the *outward Figures* of *Gamabezes*, of which sort I have seen many taken up about *Aderly* and *Pomfret* in *York-shire*, and in other parts of *England*, which do perfectly represent *Snakes*, as they usually lay roll'd up in the *Earth*, when *alive*, so as these seem to be *Snakes* petrified, only their *Heads* are wanting in all, and they are seldom above two or three *Inches Diameter*, and of a *blackish colour*, yet I have heard of, but not seen, some inclining to a *Goldish Colour*: But it was my chance in the *Year 1668.* to find (on the side of a *Stone-Cawfy*, between *Burport* and *Axminster* in *Dorsetshire*) one of the largest *Snake-stones* that ever I heard or read of, being above six *Inches Diameter*, and of a *Free-stone colour*, and one might judge that there had been an *Head* on it but broken off, and as a *Rarity* I bestowed it on *Dr. Warner* one of his *Majesties Physicians*, which was very acceptable to him.

Now as to the *inward Gamabez*, I had some years since a *whitish Flint*, inclining to a *light Blew*, which being casually broke in two, upon the inside of the two broken parts, there were

were the perfect Figures of a *Tree*, with black *Lines* and delicate shadows, such as I have seen in *Paintings*, representing *Trees* in the midst of *Snow*, and so seem'd the *black* Figures on the *white* Stone: I then thought my self well skill'd in that *Art*, so I could not but give my *Verdict* on *Natures* side, beyond any *Arboreal* Figure that ever I saw done by *Art*.

**GALLON**, *T. Kandel, L. Brocus*, and from *T. Kandel*, the word *Can* or *Vessel* (to drink with) is derived; the proportion of which differs in *England*, as it doth in *Germany*, being in some parts four, in others two quarts, which is a *Gallon*.

**GARDIAN**, *T. Gaerdigein, L. Gardianus.* See *Warden*.

**GUILDERS**, a *German* *Coyne* (see *Money*) also such as use to lay *Leaf Gold* upon *Metal*, or otherwise, to make it appear like *Gold*, are called *Guilders*, *T. Guilder, L. Aurare*: see *Mony*.

**GLASS**, *T. Gleizen, L. Vitrum*, is by fire produced from all *Metals*, but that which is of most use for helping to dissolve *Metals*, is produced from the *Dross* of *Lead* or *Tin*, and so called *Speize Glass*, and *Tin Glass* (*l. 1. c. 8. and l. 2. c. 23. See Lead.*)

There is also that which is called *Glass-Gall*, *Glass-Cup* or *Hematithe*, a *Stone* of which *Glass* is made, and used also for *Metals* (*l. 2. c. 3. and l. 3. c. 5.*)

**GLASS-CUP**, *T. Glass-Kup and Blutstein, L. Homatites, A. Blood-stone* (*l. 1. c. 34. 59.*)

**GLASS-GALL** (*l. 3. c. 5. 52.* See *Glass*.)

**GOE**, or to *goe*, the word is commonly used as a motion to the dissolving of *Oar* or *Metal*, and signifies much of the same with *driving* and *flowing*, being only *degrees* and *terms* of *Art* towards *dissolution*.

**GLIMMER**, or *Glumering*, *T. Glantz, L. Splendere, A. shining Oar*, which the *Latines* call *Rutilatio* not properly so applicable to *bright Oar*, but *Resplendescencia* may do well enough. (*lib. 1. cap. 2. 5. II. & lib. 2. & lib. 3. 7. 4.*) See *Oars*: and

and sometimes, it is taken for *Tallow*, *lib. 2. cap. 28.*

**GOLD**, *lib. 2. &c.* It was writ so by the old *Saxons*, and *Britains*, and still so by the *Danes*, but the *T.* now *Goldst* and *Belgick Gout*, and if we observe what little difference there is between *Gott*, *Gut* and *Gud*, used in these two Languages for *God*; and *Gout* and *Goldst* for *Gold*: We may well think those *Ancients* did make this *Metal* their **GOD**; and that we may not altogether blame them, we may well bring-in the *Spanish* and *Italians*, who call this *Metal*, **ORO**, signifying to *pray*, as if it were a *Metal*, to which their Fore-Fathers did pay their *Devotions* and *Prayers*: and all of us seem at this day to be guilty of this *Metallick Idolatry*: but to prevent that Imputation, the *Latines* call it *Aurum*, and *We Gold*, being of a different *Dialect*, from almost all the present *European Languages*, except the old *saxons*, as I said, and *Danes*.

Now, as *Quicksilver* is called *Mater*, so this is called *Pater Metallorum*, and therefore there may be some Dispensation for a *filial Love* to the nobler Part of our *Mother Earth*, especially if it be without *idolatrous* and *covetous Applications*. We have little *natural Gold* in *England* from any of our *Mines*, yet we are not altogether without it, for I am assured from a *Cornish Gentleman*, that hath a considerable Interest in the *Stanneries* of *Cornwall*, That in digging for *Tin*, they often find little *Grains* of *Gold*, not in the *Tin-metal*, but in the outward sandy circumjacent parts of their *mines*: and that the biggest he ever saw, was not above the bigness of a small *Pea*, nor need we much to search for it, or labour artificially to make it: for what we have from other parts in *Africa*, *Asia*, and *America* do sufficiently supply us, especially our late *Trade* with *Guinea* in *Africa*, from whence 'tis brought to us in little *Grits* or *Seeds*; yet I was told by an eminent *Goldsmith*, That he had often bought pieces of above an ounce in *Weight*, and that was so good, that though it had not an high *Colour*, yet the *Colour* was recompenced by  
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the little loss in melting : Whereas the *Seeds* of other *Gold* are much adulterated with the *filings* of *Iron*, which they draw off by the *Loadstone* : but when they bring their *Artificial Gold*, made into *Duccates*, they are first to use their *skill* in separating a considerable quantity of *Silver* from the *Gold*, which is commonly made by *Art*, to contract the *Gold*, whereby it will indure the *touch* like *Gold* : but their *scissors* soon decide the Controversy, and cheat : so as *Art* discovers the *Artificial Gold* from other mixt Metals. Our *Author* saith, *lib. 2. c. 1.* That the *seed* of *Gold* came out of *India* by *Nilus*, wherein he is mistaken (as other former *Antients* were) in taking *Gebon*, in *India*, to be in *Asia* ; of which Mistake, *Sir Walter Raleigh* hath convincingly shew'd their *Error* (*H.M.l.1. c.6.*) Yet very probably *Nilus* may afford Variety of *Gold*, in respect it hath its *Heads*, from the two great *Lakes* of *Zambre* and *Zailar* (and not *Zambre* alone, as *Dr. Heylen* would have it) in the lower *Æthiopia*, and passeth the upper *Æthiopia*, or *Habasines Empire* ) which is full of *Gold*, and then running above 2000 miles, and so may well bring it into *Ægypt*, and from thence cast it into the *Mediterranean Sea*, and by that Sea tost into *Asia* and *Europe* : But, as I said, We have a shorter and better way for it to *Guinea*, in *Africa*, from the river *Nigro*, and the Coasts of it, and that we may the better credit a greater *Efflux* of *seeded Gold* from thence, than from any other in *Africa*, 'tis found by late *Geographers*, that this *River* doth rake the very Bowels of the Earth for it, for it seems (as they tell us) that it hath its rise from a great *Lake*, called the *Black Lake*, within two *Degrees* or 120 Miles of the *Equinoctial* (and within four *degrees Eastward* of the *River Nile*) and so it runs *Northward* about 600 Miles) whereof under ground about 60 miles) and then riseth again and falls into the *Lake Borneo*, from whence it bends its course directly *Westward* (differing from the course of *Nile*, which runs directly *North*) and so after it hath run above and under ground more than 3000 miles (through many *Kingdoms* and *Countries*, rich in *Gold*) it

unlades its *Treasure* into *Guinea*, by many lesser streams, where the Natives are always dealing for *Gold*, and it self at last in the *Atlantick* Sea, over against the *Islands* called *Hesperides*; so as we never cross the *Equinoctial* to go thither; which is less trouble than unto the farthest part of the *Mediterranean* Sea, where *Nile* vents it self: or to the Mouth of the two Eminent *Rivers* of *Ganges* or *Indies* in the *East-part* of *Asia* (and therefore called the *East Indies*;) Now where the land of *Havilah* which *Pison* encompasseth (mistaken for *Ganges*) wherein there was *Gold*, and the *Gold* was called *good*; as also where *Paradise* was, or is, whether beyond our *known World*, or the *Middle Region* of the *Air*, or elevated near the *Moon*, or as far *South* as the *Line*, or as far *North* as that *Line*; or whether near *Havilah* in *Africa*, or *Havilah* in *Asia*; or whether a place called *Eden* or *Paradise* was peculiarly created for the *Reception* of *Adam* after his *Creation*; and *Christ Jesus* after his *Resurrection*; I shall leave to *Sir Walter Rawleigh*, and others to determine, but we are assured from the sacred *Story*, that there was *Gold* near that Place, and that then (in the *Innocency* of times) the *Gold* was good; which must be known by *Assaying*, and doubtless that *Knowledg* was communicated to *Adam*, yet we hear no more of *Gold* in that *Holy Writ* till 2800, after *Adam* (though it was accounted the *Golden Age*) and then, (*Gen. 24. 22.*) *Rebeccah* was presented with *Gold-Earrings*, and *shekles* of *Gold*, so it seems they had the *Art* of *Melting* and *casting Gold* into *Assayings* and *Forms*, as may be collected from the several *Distinctions* in the *Sacred History*, concerning *Beaten Gold*, *pure fined* and *refined Gold*, and *crown Gold*; And we are assured that in *Moses's* time, they had the *knowledg* of all *Metals*, as may be read in *Numb. 31. 21.* where *Moses* taught the *Soldiers* how the *Spoils* of their *Heathen Enemies* were to be purified, commanding (as from *GOD*) That all their *Gold*, *Silver*, *Brass*, *Copper*, *Tin* and *Lead*, and every thing that endureth the *fire*, (in the *furnace*, according to the

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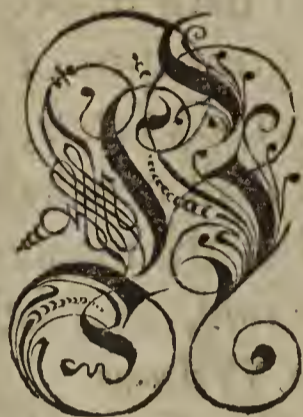
*Syriack*) should be purified by *fire*, and then to be accounted *clean*: yet, it is also said in that *Text*, That it shall be purified by the *Water of Separation*, by which *water* certainly is meant *Quick silver*, because this doth *purify, cleanse and devour Metals*; and so *Dr. Salmon* calls it a *Volatile fuyce or Liquor*; for nothing but *Fire* or that *Quick silver* or *Aqua fortis* can separate those *Metals*.

Now of that *Text*, the *Commentators* gives but little account, passing it in general, only as a *Water of Purification*; whereas there were two sorts of *Water of Purification*: viz. that which is mentioned for *purifying Metals*, and this other for *purifying Men and Women*, which in *Numb. 29. unto. verse 11.* is plainly set down, how, in what manner, and with what *Ingredients* it was composed: viz. that a young *Red Heifer*, without *spot* and without *blemish*, and which was never put into a *Yolk*, was to be brought to the *Priest*, and one was to slay her before his *Face*, and the *Priest* was to take some of her *Blood* with his *finger*, and *sprinkle* it *seven* times before the *Tabernacle* of the *Congregation*; and then the *Heifer* with her *Skin, Flesh, Blood* and her *dung*, was to be burnt in his sight, and whilst it was burning, he was to cast into the midst of its fire, *Cedar-Wood, Hyssop* and *Scarlet*, and after that, both the *Priest* and he that burnt the *Heifer*, washed their *Cloaths* with *Water*, and bathed their *flesh* also in *Water*, and yet they remained *unclean* until the *Even*: (by which time, it may be supposed, that all was dry'd) in the mean time, one that was *clean* was to gather up the *Ashes* of the *Heifer*, and lay them up clean without the *Camp*, and he also, for this *act*, was to be accounted *unclean* until the *Even*; and these *Ashes* were kept (as *Lees*) to put into *Water*, which was call'd the *Water of separation* for the *Congregation* of the *Children of Israel*, as also for *strangers* sojourning with them to be *sprinkled* with, and thereupon also called the *Water of Purification* for *sin*, *ver. 9.* so as we see clearly this *Water of Purification* of *Men*, was a distinct *Water* from the *water* of *Purification* and *Separation* of *Metals*; and the *Ingredients* of

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here it doth signify such *Metals* as one doth grind small. *T. Malen* and *Gerienen*, *L. Molare*, that is, being ground, it is a Foundation to other proceedings.

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**H** AND. *See Measures.*  
**H** HEARTHS. *See Ovens.*  
**H** HELLER. *See VVeights.*


**HELM**, *Helmet. T. Helm, L. Tegumentum*, made of *Clay* or *Iron*, used in the *Metallick Art*, for covering of *Ovens*, &c. as in *sculpture XVII. &c.* the Word is also used for an *Head-Piece* in time of *War*, and for the chief *Rudder* that guides a *Ship*, all signifying something of a *Defensative* or *Preservative Nature*.

**HEMATHITE**, which is no other than the *Blood-stone*, of a dark-red colour, *L. Hematites, T. Blutstein.* *Pliny* saith, It is of Kin to a *Load-stone*, of which there are ten sorts, but that which is called *Hematites Fossilis* (digg'd out of *Iron Mines*) is of a *Purple Colour*, which we do not find in *England*, and but some few of the other. *See Glass-Cup.*

**HERMETICK-SEAL**, that is, to joyn the Mouth of a *Glass*, first heat in the fire, and then nip together by *Pincers*; so called from *Hermes* the first Inventor. *Pliny.* *See Cement.*

**HORNY.** *See Horny Oars.*

INCH.

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**I**NCH. *See Measures.*

**I**NCINERATION and *Reverberation*, are two sorts of Methods in *Calcining Metals.* *See Calcine and Ashes.*

**I**NCORPORATE or *Incorporation*; that is, when *Metals* are mixt, they are called *Incorporated*, or their Bodies joyned together: and from hence *Bodies Politick*, or a number of Men joyned in a *Fraternity*, are called *Incorporations*, because they consist of all sorts of *Tempers* and *Metals.* l. 2. c. 1. s. 2.

**I**NFUNDING, *Infusing* and *Infusion* (*lib.* 1.) that is, a pouring or putting: in but the *Infusion* of *Metals* and of *Plants* have two ways of proceedings. *See Fusions.*

**I**NGOT, called by that name in the *Teutonick* and *English*, and is a little long *Vessel* wherein *Gold* is cast, which *Vessel* is called an *Ingot*, and the piece of *Gold* taken out of it hath the same Name. l. 2. c. 47. and *Sculp.* XXVIII. *Fig.* 5.

**I**NSPERG is oft used in *Erkern*, from *Inspergo*, when one *Metal* hath certain *parcels* or *sprinklings* of other *Metals*, whereby their goodness is seen before *proving.* l. 4. c. 1.

**I**NSPISSATION, is the method of *Fixation* of *Metals.*

**I**NSTRICK, is a Term of Art, used to signify the first work in *separation* of *Metals,* l. 3. c. 22.

**I**RON and *Steel*: *see Metal*: *T.* *Eysen*, *Iron-man*, *L.* *Ferrum* and *Chalybs*: l. 2. c. 20. s. 2. *see Oars,*

**J**UG, *T.* *Krug*, *Heb.* *Chug*, *A.* *Jug* or *Pot*: so it seems we do retain the Word, which is of little difference from the *Hebrew.* KE-

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**K**ETTLE, *T. Kessel, L. Cacubus.* See Utenfils.  
**K**ELL or *Kiln*, or *Kill* for metallick Matters, *T. Kalck-Ofen, L. Fornax* and *Calcaria, A. Kill*, they are also used by that name, for drying *Malt*, &c. See Furnaces and Ovens.

**KEINSTOCKS**, I retain the word as very proper, and is fully explained. *l. 3. c. 22.* See Thornels.

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**L**ADDER. See Utenfils.  
**L**EACH (*l. 3. c. 26.*) this word I retain signifying *hard work* (often mentioned by *Erkern*) and the *Etimology* may be, because such *hard Work*, do occasion *Le Ach*, on the *Ach* in the *Joynts* of the *Operators*.

**LAMINS.** *T. Bleck, L. Lamina, A. the Plates of Metals.* *l. 4. c. 4.*

**LAPIS LAZULI**, *l. 1.* of which *Blue Vitriol* is made.  
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LAPIS CALAMINARIS, L. *Cadmia*: see *Cadmia*, *Calaminaris* and *Stones*.

LAPIS TUTIJ, a *Compound* made of *Calaminaris*, good for sore Eyes. See *Calaminaris* and *Stones*.

LATTEN, T. *Latton*, *Auri Chalcum* and *Orichalcum*, also *Coronarius*, and is a *Compound* of *Copper* and *Lapis Calaminaris*, and so cast into *Forms* and not wrought with *Hammers*, in respect of its *friableness* or *brittleness*, that which is also made of thin *Plates* of *Iron* and so *Tin'd* over, is vulgarly called *Latton*. See *Plates*, *Iron*, *Tin*.

LEAD, T. *Bley*, L. *Plumbus*; it is called also (*Howel*) *Aurum Philosophorum*, because it doth as it were govern *Gold* and other *Metals* in their *Precipitations*, and from thence wee use this word to *lead* or *conduct*, because this *Metal* doth as it were, *lead* and *conduct* us to the knowledge of all other *Metals* (l. 4.) and several other parts: see *Metals*; and certainly no *Metal* hath more excellent effects in *Chyrurgery*, than the *Artificial Leads* made of it, under the names of *white* and *red Lead*, and therefore it is put under the highest *Planet Saturn*, slow in *motion* and sure in *operation*, and of this virtual *metal* we have as good and as great quantities in *England* and *Wales* proportionably, as in any parts of *Europe*; besides the great quantity of *Silver* contained in it: But before I close this *Discourse* (because it was omitted in the word *Ceruse*) I must inform you, that for this *common Lead* (which is a *natural Metal*, and plentiful in all our *Mine-Countries*) there are *Mills* erected (such as the *Society* for the *Mines Royal* have in *Wales*) where they make *white Lead* (which is only a *product* of that *Metal*, *Lead*, corrupted with *Vinegar* or *Urine*, and afterwards being ground in the *Mills*, and formed into a *white colour*, is called *white Lead*, and after that *Refined*, and then hath the name of *Ceruse*, which yields the best and most perfect *white*, and at these *Mills* there is made also *red Lead*, of the *common Metal Lead*, and is brought to that *colour*, only by the *Art* of using *Fire* to it; and both being thus made, as

well the *red* as the *white*, are of excellent use, not only for *Painters*, &c. but to all *Chirurgeons* (as I have said:) There is also a *mineral Lead*, which we call *Black Lead*, something like *Antimony*, but not so shining or lollid, of which fort I know but of one *Mine* in *England*, and this yields plenty, both for our selves and other Nations, and this *Mine* is in *Cumberland*, which they open but once in seven years (I suppose the reason is, least they should dig more then they can vend) this also is used by *Painters* and *Chyrurgeons*, &c. with good success, especially being mixt with the products of *Metals*: and of late, it is curiously formed into cases of *Deal* or *Cedar*, and so sold as dry *Pencils*, something more useful than *Pen* and *Ink*.

There is also a white *Mineral* in *England*, called *white Chalk*, tending to a transparency, but of a *Leadish* quality, and therefore I place it here, rather than under *Earths* or *Stones*.

LEAD-GLASS. See *Fluss*.

LEATHER. See *Utenfils*.

LIMBECK, T. *Alimbick*, L. *Alimbicus*, quia extrahendo materiam lambit (*Minshaw*) and also called *sublimatorium*, quia materiam evehat in sublime, and he saith, it is an *Arabian* word; but in short, it is a kind of an *Oven* or *Furnace* made of *Metals*, vulgarly called a *Still*, and used more for distilling *Waters* than *Metals*, and is sometimes mentioned by *Erckern*, but chiefly as an *Helmet* to the *Athanor* or *great Furnace* (l. 2. c. 32. s. 7.) Now of these *Stills*, I deny not but those which we commonly use, are very fit for their purposes; but I have contrived one (whereof I have made often *Tryals*) which perform the like, with much less *fire*, and less *trouble*, because the *fire* need not to be tended but once in 10 or 12 hours, and the *Waters* (of several sorts) which I have *Distilled* in it, are every way as effectual, but the *manner* and *way* of *Distilling* therein, doth every day improve in my *Experiments*, and when it is fitted to effect all the intents and purposes of the *common Stills* (with some additions, which they cannot perform) I shall divulge

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vulge the *Invention*, without *Patent*, or any expected *Reward*, but thanks. See *Quick-silver*.

LIMETS. See *Files*.

LIME-CALX, I have writ something of this, under the word *Calcine*; but now I shall speak of *Lime*, or the *Calx* of *Lime-stone* or *Chalk-stone*, which *Calx* is used both in *Cementings*, *Lutings*, and in melting of *Metals*, with other *Ingredients*, but the great use of this *Lime*, is to make *Mortar* for *Buildings*, and therefore I shall refer it to the word *Mortar*; only observe this, That when *Lime-stone* or *Chalk*, whilst it is immediately from the *Pit* or *Quarry* (because it is properly a *Stone*, though of a soft nature) is called *unslack't* or *unburnt Lime*, but when it is burnt, called *slack't*, and so all *Metals* *unburnt* or *burnt* may be also called, *unslack't* or *slack't* and the pieces *slackes*, which word is often used.

LINNEN. See *Utensils*.

LIQUATION, L. *Liquatio*, from *Aqua & liquidus*: A liquor or moisture: and *liquation* is a term in this Art of *Chimistry* for one of the Methods in dissolving *Metals*, and the word *liquifaction* of the like sense, and from the same *Radix* is also applyed to *Metals* when they are melted by the heat of *fire*, or *Sun*: See *Conglutination*.

LITTARGE, T. *Blegg Leidt* or *Glet*, L. *Lithargicus*, or the *stone* of *Gold* or *silver*, from the Greek *Lethos*; and sometimes called the *spume* or *froth* of *Gold* and *Silver*, but generally the *Excrements*, *scoria's* or *Dross* of *Gold* or *Silver* caused by *Lead*, and if it be *Gold-Litarge*, it looks of a *Yellow* Colour and tho it be *dross*; yet the *Metallists* give it this distinct name, because it hath more excellent *Virtues* than any other *Excrement*, *Recrement* or other *Dross*, and that it may be cleared from other words of almost the same sound; I think it fit to distinguish them here: This word is written *Littarge*, and by some *Lithargy*, and that which signifies the publick Office of *Devotions*, LITURGY; and the *sleepy* Disease, LETHARGY (with an E:) and I wish that the plenty of

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our *Littarge* or *Lithargy* may raise up our *Litturgical Devotions* to be delivered in all times of our *Wealth*, and from the *Lethargical* or *sleepy hours* of *Death*, as well by our *Devotions* as by the excellent *spirits*, &c. made of our *Littarge* peculiar to that *Apoplectick Distemper*. (See those words.)

LIXIVIUM, See *Menstruum*, *Lee* or *Lees*.

LYE, called also *Ligh* or *Lees*, to distinguish from a *lye*, or to *lye*, or to speak *untruth*, or to *lye* or *lay* down to rest.) T. *Langen*, L *Lixivium*, from *Lix* signifying *Ashes*, or as *Minslow* calls it, *Humor Cineri mistus*, of which see more in *Buck* and *Menstruum*. And here I may observe that as in *Latine*, *Lix* signifies *Ashes* so *lixa* is *Water*; and those two mixt, makes the *lees*, with which women *wash* and *buck* their cloths for so *lixa* also signifies.

LOAD-STONE or *Magnet* (lib. 4. cap. 21 and 22. f. 4.) T. *Magnet steine*; but when it hath relation to *Navigation*, 'tis call'd *Segel-steine*, or *sail-stone*; but the *Latines* *Magnes* and *Magnificus*: and A. from the *Saxon*, *Load* or *Leading stone*, or *lapis cujus ductu Nautæ instituant cursum*; and *Erckern* for this and many other qualities calls it a *Jewel*, and 'tis pretty to see how the *Latines* quibble about this word *Magnes*, for they call a great Man *Magnas* (on the account of *Honour*;) and *Magnus* great, on the account of *bulk*, &c. and this stone *Magnes*, being of so great *Virtue*, that it is scarce *comprehensible*, and 'tis probable, that the other two words do borrow their titles from it.

*Pliny* tells us, (lib. 7.) That this word *Magnes* was given from *Magnes* the Name of a *Shepherd* who was the first finder of it, and makes five kinds of it (lib. 36. cap. 16.) *Cardanus* but three kinds, who observes, That *Aristotle* was altogether ignorant of the *maratine* use of it, and that *Galen* and *Al. Aphrodosius* (two great Inquirers into the secrets of *Nature*) have not so much as once mentioned the wonderful *Nature* of this *Stone*: but now *Authors* do abound in their discourses upon it, and make all things easy and plain in their *Naratives* of its *Vir-*

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*tues* and Operations: only when their Discourses are applyed to its *Variation* by the *Needle* (touch'd with it for the use of *Navigation*) there they disagree very much in their Opinions; and amongst the rest, *Boetius* tells us, (*cap. de Magnete*) that there are two *magnetick* Mountains; and that those *magnets* which are digg'd nearest to the *Artick Pole*, have most of the *Artick Virtue*; and such as are digg'd nearest to the *Antartick*, have most of the *Virtue* of the *Antartick*; which is the cause of their *Variations*, and many other pretty and plausible notions are writ of them, but I shall only mention some of my own Observations.

1. That this *Stone* is found in most *Iron-mines* in *England*, but are not so effectual in their *attractive power* as those which we have from *foreign Parts*, and therefore ours need to be nourished with *filings of Iron* (for stones have a *vegetable life* to be preserv'd) and to be kept from the *Juyce* of *Onions* and *Garlick*, and moist places, which do unglutinate, and so destroyes or subdues their *Virtues*: and therefore those *Lapidists* whose Art it is to fit *Loadstones* for *Navigation* (or other uses) will not suffer those *Plants* to be near them: and I have often try'd, That when I have touch'd my knife with a *Loadstone*, and thereby impowred it to take up *Needles* or small *Weights* (and so it holds its *Virtue* many dayes) but the *Knife* once touch'd with an *Onion* doth utterly loose the *Virtue* which it borrowed; I confess I never tryed *Onions* or other *acid things* to the *Poles* of my *Loadstone*, because I chose rather to believe than hurt the *Stone*: especially a *Lapidist* of my Acquaintance affirming the *Truth* of it, who was so great an *Artist* that he told me, That with a *Magnet* of the bigness of my head, he could drive the *Soul* of it, into as little a compass thereof as a *Nutmeg*, but before I could see the *effects* of his *Art*, I was diverted with other Occasions, and could never find him after. Yet it was my good fortune to be acquainted with a worthy Gentleman *Francis ~~Smith~~ Esq;* (of *Finch Rusboke* in *Worcester-shire*, since deceased) who was Master of

much sound *learning* and very ingenuous in his Discourses, when he thought fit to expatiate himself; or otherwise reserv'd: and we happened upon the Discourse which I had with the *Lapidist* upon which he produced a *Loadstone*, fixt with its irons for the *North* and *South points*, which I had the freedom to weigh in my *Gold-Scales*, and the *Iron pieces* and *points* and *Gold* (for *Ornament* which embraced it) weighed just *eleven grains*, and it attracted a *piece of Iron* of an ounce weight. Now, there being according to the *Venetian* account 6912 *Grains* to a *pound*, every ounce is 576 *grains*, which is 52 times 11 *grains* so that it took up an *Iron* of above 52 grains more than its own weight (considering its embracers) and by my description of the *Lapidist*, he believed, it was bought of the same person and looking upon it as a very great *Rarity*, I took upon me the Confidence to tell him, That it was pity so great a Jewel should lye concealed, and added, that I believ'd it would be a very acceptable Present to his Majesty: He approved of my Proposal, and accordingly did present it, and it was so accepted, and got a good *Office* soon after, I cannot say for that, (though it deserved it) but for his own Deserts, and I hope it is still preserv'd amongst his *Majesties* *Rarities*.

Another piece of Curiosity I saw in the Hands of Sir *William Persal* (since Deceased also) viz. a *Terrella* or *Load-stone*, of little more than 6 *Inches Diameter*, turned into a *Globular Form*, and all the *Imaginary Lines* of our *Terrestrial Globe*, exactly drawn upon it: viz. the *Artick* and *Antartick Circles*, the *two Tropicks*, the *two Colures*, the *Zodiack* and *Meridian*; and these *Lines*, and the several *Countrys*, artificially *Painted* on it, and all of them with their true *Distances*, from the two *Polar Points*, and to find the truth of those *Points*, he took two little pieces of a *Needle*, each of about half an *Inch in length*, and those he laid on the *Meridian line*, and then with *Brass Compasses*, moved one of them towards the *Artick*, which as it was moved, still raised it self at one end higher and higher

higher, keeping the other end fixt to the *Terrella*; and when it had compleated it Journey to the very *Artick Points*, it stood upright upon that *Point*; then he moved the other piece of *Needle* to the *Antartick Point*, which had its *Elevations* like the other, and when it came to the *Point*, it fixt it self upon that *Point*, and stood upright, and then taking the *Terrella* in my Hand, I could perfectly see that the two pieces of *Needles* stood so exactly one against the other, as if it had been one intire long *Needle* put through the *Terrella*, which made me give credit to those who held, That there is an *Astral Influence* that darts it self through the *Globe* of *Earth* from *North* to *South* (and is as the *Axel-Tree* to the *Wheel*, and so called the *Axis* of the *World*) about which the *Globe* of the *Earth* is turned, by an *Astral Power*, so as what I thought *imaginary*, by this *Demonstration*, I found *real*; and am convinc't by this, and other *Experiments*, That not only the whole *Earth* is guided by this *Astral Influence*, (fixt in the *Septentrional* and *Astral Points*) but every particular within the circumference of the *Terrestrial Globe*, hath a *Magnetick tendency* to the *Septentrional Points*, naturally fixt in them, as may be Experiment'd in *Plants*, *Stones* and *Metals* (of which one might write a large *Volumn*) and it is commonly known, that in *Clay*, which have not been formerly dig'd (as I mentioned of that under my House (in Title *Clay*) being dig'd in pieces of 6 *Inches*, more or less in length, make them into *Rolls*, pointed at each end, and hang them with a *thread* in *Equilibrio*, and they will turn themselves to the *North*, to shew that there is an *obedience* in all *Vegetables*, to the *Septentrional Astral* conduct, and so it may be evident on every other *Vegetable*; and though the *lesser sorts* of them can scarcely be experimented, in respect of their *minuteness*, yet in *Plants* of greater bulks, we may see the *predominancy* of the *North Point* in their *vegetation*, which is the reason, why *Plants* that are removed do not grow, or but very slowly, till they have recovered their first *position* to the *North*, by a second compliance to the *Northern Magnetick Attraction*.

And

And it is not only thus in *Vegetables*, but in *sensitives* and *Rationals*, which I might enlarge: yet before I leave this *Discourse*, I cannot but say something of the *Constellation* that attends this *Artick Point*, which is called *Cynosura*, pretended in the stories of *Constellations* (see *Dr. Hood*) to be the Daughter of *Calisto*, and so had the name of *Ursa minor* (a Female) yet hath the tail of a *Dog*, and the end of that tail is called the *Pole-Star*, and this *polar Point* is called also *septentrio*, from the *seven stars* which hover about it, and those seven *Stars* called *Septentriones*: Now the *Scythians* held the *polar Point* to be an *Iron Nail* (which is our *Axis*) and this they adored as a *God*, and before the *Load stone* was known for *Navigation*, the 2 stars on the shoulder of this *Bear* or *ursa minor*, were *Directions* to the *Spaniards* instead of a *Compass*, *Card* or *Needle*: the like is said of the *Constellation* (called *Helyce*, Sister to *Cinosura*) which is in the *Southern Point*, fixt in *ursa major*; and the seven chief of this *Constellation* are called *Charles's Wayne*, and are in the hinder part and *tail* of this great *Bear*; but I have said enough of this, especially concerning the *Scythians* belief, that it was *Iron* (probably not then knowing the Name of the *Load-stone*, and therefore called it *Iron* instead of *Load-stone*;) but to pass these *Metallick* Parts of the *Terrestrial* Globe, and *celestial* Influences attending them. I cannot but recommend the Experience I have had (in lying in my bed with my Feet to the *North* and Head to the *South*) in my rest, sleep and dreams, from other *Positions*, which I leave to the Consideration of others; and return to the *Magnetism* of *Metals*; wherein all *Chimists* agree, That *Gold* is the *Magnet* of *Quick silver*, *Iron* of *Copper*, *Copper* of *Silver*, and *Tin* of *Lead*; and these *Magnetisms* are still guided by *astral Influences*, not only of the *seven Peculiar Planets*, to the *Seven Metals*, but to the *Septentrional Axis* or *North Point*, which directs the Influences of the *Seven Stars* upon the *Seven Metals*. And now I shall conclude, and refer you to that admirable Experiment which our *Author* mentions of this *Jewel*, l. 4. c. 20. (collected

cted from *Serapion* (an old Philosopher) as also to *Cardanus*, (a known Author) who tells us what he had experimented, *viz.* That if a *Knife* be touch'd with a *Load-stone*, it will enter into any part of *Man's Body* without sense of *Pain*, not only in thrusting it in, (which is common to all *Weapons* till the *Air* entreth the *Wound*) but also when it is drawn out.

Yet I cannot leave this pleasant *Subject*, till I have imparted my own *Experiments*, in making this Jewel (for so *Erckern* deservedly calls it) useful to inform us, as well of the *Ebbing* and *Flowing* of the *Sea*, as of the *Alterations* of the *Weather*, and to that End, I fram'd a *Model* or *Case* (as is here represented, but covered with *glass*) with a pair of *little wooden scales* artificially hung by a *thread* to a thin piece of *Wood*, plac'd between the two *iron Points* of the *Loadstone*, so as the two *Scales* may hang true under each *point*, and at each end of the *wooden Beam* of those two *Scales*, I fixt two little pieces of *Iron*, to answer the two *points*, whereby the attractive power of the two *Iron Points* of the *Loadstone* might operate its *attractive power* on the two *lower pieces* of *Iron* on the *Beam*, and then in one *Scale* I put in *Quick-silver*, and in the other certain little *weights* proportionable to the *weight* of the *Quick silver*; and on the *Center* of the top of the *frame* I placed an *Horizontal Dial*, with a *Compass-Needle* in it (such are commonly sold) and on each side of the *frame* (at equal *Distances* from the *Center*) I placed also upon an extended piece of thin *wooden board*, two more such *Horizontal Dials* with *Needles*, so as the *Gnomon's* of all three, might answer each other in a *diametrical Line*. But having been hindred in perfecting my real *Apprehension*, of obtaining thereby many pleasing and useful *Experiments*, I must refer the further account of them, till another time.



**LOAM**, *see* Clay.

**LOTH**, *see* Money.

**LUMP**, *l. i. c. 4.* Teut. *Klumpen.* L. *Massa*, or a piece of any thing compos'd of *hard*, and *moist*, *mixt*, as *Clay*; &c. but in a mixture of *Metals*, 'tis called *Bolus*, and in mixture of *light Earths*, *Gleba*: and we also call a *fish* (which is common in our *Markets*) a *Lump*, in respect of its form, close, and compacted without a regular shape, and the word may well

M A      W O R D S Metallick      M A

well come from *Lumbus* or *Lumbricus*, by changing *b* into *p*, which two *Letters* differs not in their *labial utterance*, but by the addition of some other *Consonant* or *Vowel*: also *Lumbus* is properly a *Store-house* (for refuse *Metals* or lumps of *Metals*) and for other *Wares*.

**LUTE**, *Luting*, The *Teut.* calls it *Laum*, the *L. Lutum*, and they have a word called *Testudo*, which signifies not only the outward *Case*, or *belly* of a *musical Instrument* called a *Lute*, but also *Clay*, and as *Lute* for *Clay*, and as *Lute* for a *musical Instrument*, are *synonimus*, so they are in their *operations*, for as the *Belly* of a *Lute* serves for *reverberations* of *Sounds* which makes them *musical*, so these *Lutes* or *lutings* serves in a *Chimical Notion* to *reverberate* or *repercuss* the *spirits* of *Metals*, to make them *harmonious* and *useful* to *Chimists*, and consequently to others who partake of their *Art*: and therefore the *Chimists* have a *Past* or *Clay* compounded with many *Ingredients*, whereof the chief is that which they use about the necks of their *Retorts*, &c. which they call *Lutum Sapientiae*, shewing the *Wisdom* of the *All-Disposer*, that, that *Earth* which preserv'd the *Metal* whilst *quiet* and *undisturb'd* in its *Bed* or *Mine*; is now made use of also, to keep its *spirits* from being *useless*.

M A



M A

**M**AN, See Vir.

**M**MARCASITE, T. *Marcasit*, L. *Pyrites*, and we *Marcasite*; *Erckern* saith, It is rich in *Gold*, Dr. *Salmon*,

mon calls it *Bismuth*, but I find it to be no where else, and makes it to be one of the *Recrements* of *Silver*; he agrees with other *Lapidists*, that there is both a *Goldish* and a *Silverish* *Marcasite*, the one yielding *Silver* the other *Gold*, however, they are excellent *Fire-stones* which we find in our *Mines* in *England*, but not so good for *Fire-locks*, as those which are brought from *Germany*, &c. And our *Marcasites* do neither afford *Gold* nor *Silver* worth the charge. *Diascorides* saith, That *Brass* may be made with composition of this stone, but that will not quit cost, because the *Marcasite* is not so soft as *Calaminaris*, but it may be tryed whither by mixing it with *Calaminaris* it will not give a nobler *Tinge* to *Brass*, and because it is not generally comprehended in *Metals*, but of an *Epicene* or doubtful *Gender*, I shall refer it to *Stones*.

MARBLE, T. *Marmelsteine*. L. *Marmor*, and A. *Marble*, which is but a little Variation from the general Name of *Marmor*, in Greek *Marmoras*, and we have several sorts of them, which consist of various colours and uses, and of these we have in *Devenshire*, and other Counties in *England*, good white and black, brown, blewish, green, serpentine, yellow and grey, faintly intermixt, and though, ours consists of various colours and degrees of hardness, yet they are short of those which are brought us from beyond Sea, or at least we think so; and as for the *Porphyry* or red *Marble*, we have none of it that ever I saw: And the *Alabaster* which is a kind of soft white *Marble*, we have but little good of it, but of the *Lapis Lidius* or *Touchstone*, which indeed is a kind of black *Marble*, by which (being polish'd) *Goldsmiths* try their *Gold* without *Touch-nedles*) and of these we have plenty, especially in *Darbyshire*. (See *Touchstone*.) but the Occasion of *Erckerns* mentioning *Marble*, is because the stone is the hardest of any common stone, and so used by *Painters* to grind their Colours on, and for reducing *Metals* into *Dust*, by *Metallists*. See *Lime*, *Morter* and *Stone*.

MARK, T. *Merch*, L. *Marca*, signifying eight ounces,



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ces; the Word in *English* is applyed eight several wayes: See *Dictionary*s.

MARK CUTTING, that is, cutting of pieces of *Metal* which are mark'd out to be divided, so the Art is in dividing of the pieces to be cut, whereby they may bear a just proportion of weight one with another, and this is performed only with a cold *Chizel* (*Dr. Revell.*)

MARLE, T. *Marghel*, L. *Marga*. See *Earth*.

MATRAS, We retain the same Name. See *Utenfils*.

MEASURE, T. *Masz*, L. *Mensura* which are considered either of *Longitude*, *Latitude*, *Altitude* or *Profundity*: and these are sometimes used distinctly, or joyntly, and so reduced to *Measures* of *Application*, T. *Zupburgung*, and to *Measures* of *Capacity*, T. *Emphaung*, the first of the four (called *Longitude*, L. *Longitudo*) is termed also in T. *Masz*, A. *Length*, but the Latine hath variety of Words adequated to the extention of things to be measured, as the Measuring of *Lands*, *Geodesia*, &c. 2. *Latitude*, T. *Breit*, A. *Bredth*, *broad*, and *large*, L. *Largus*, and *Latitudo*: 3. *Altitude*, L. *Altitudo*, T. *Die habe*. A. *Hight*. 4. *Profundity*, T. *Lage*, L. *Log*, and *Profunditas*, A. *Depth*, *deep*, and many other names, according to the proportion of *natural* or *artificial* *Contentures*, as *Cyathus* and *Coclearium*, &c. about which *Dictionary*s may be consulted, for I speak only of such as are mentioned by *Erckern* for *metallick* uses, of which some are *uncertain* measures, (viz. a *Fingers* length and bredth, an *hands* thickness, and *breath*, a *span*, a *mans* foot, a *cubit*, &c. and some certain, viz. a *yard*, an *ell*, a *fathom*, &c. and of the *mensuræ* *Capacitatis*, some are also *uncertain*, as *Crucibles*, *Tests*, *Cruises*, *Jugs*, *Pots*, &c. and some certain, as *Pints*, *Quarts*, *Galons*, &c. of which in order; And first of the *Finger*, T. also *Finger*, L. *Digitus*, which signifies the length and bredth, but we may read in *Georgius Agricola* (*de mensuris & ponderibus*, and other *Books*) that they consist of several Proportions; and in *Gallen* (*de usu partium*) of several uses: and of

this word *Digitus*, *Holiock* makes no less than 24 *Observations*: but that which concerns this Subject, I have in part collected from *Cor. & Agrippa*, that the *Thumb*, or first finger (*Teut. Daum, L. Pollex*) was dedicated to *Venus* and the *Moon*; and in *Metallicks*, lucky to *Silver* and *Copper*; the *fourth Finger* to *Mars*, and lucky to *Iron* and *Copper, red* (and *yellow*, artificial, that is *Brass*;) the third called *digitus infamis* (I know not on what grounds) to *Saturn* and *Jupiter*: and lucky to *Lead, Tin, Silver* and *Gold*: The *second finger* to the *Sun* and *Saturn*, lucky only to *Gold*: the first or *little Finger* to *Mercury*, and lucky to *Quick silver, Tin* and *Silver*; and these *Notions* are the chief *Foundations* of the *Art of Chyromancy* or *Palmistry*, so that by the *Fingers* and *lines* in the *hands*, the *temper* of men might be the better known for *Metallick* and *Chimical Purposes* (but the *Poet* who ever he was that made this *Verse*)

*Miles, mercator, stultus, bene nuptus, amator* ;

applicable to the 5 *fingers*, had I conceive another prospect, to shew that their *Fate* was at their *Fingers ends*, and by the *Influences* of the *stars* did direct them to their most *genuine Employments*, whereby the *Chiromancer* might know to what one was by *Nature* adapted; and accordingly, by that *Artist*, was directed to apply himself: but to pass these *Curiosities*, it is writ by several *Authors*, that the *length* and *breadth* of the *fingers*, and so of the *hand*, gave the first *Rules* to the smaller *Measures*, the next is the *Span*, *T.Span. L. Spithama*, which consists of three parts, *viz.* the *Thumbs*, (having three *joynts*) made one; the *space* between the *Thumb* and *finger*, making the other, and one of the *fingers* (having also three *Joynts*) making the third, so in all seven; and though these *seven* do differ in proportion (the *spaces* and *joynts* being unequal) yet from the top of the *Thumb* to the top of either *finger* fully extended, was the *span*, consisting of *seven* proportions: and 'tis observable, That *David* calls mans *Life* a *span*,  
which

which afterwards he explains, by saying the Years of Man are seventy, that is, seven decimals, or seven times ten, which is seven *spans*, so as the short *span* is from the *Thumb* to the end of the fourth or little finger, but if he had a long Life or *Span* *viz.* from the *Thumb's* end to the end of the middle Finger, it occasioned but pain in the extending it (from *police* the *Thumb* to *stultitia* the *Fools Finger*) which is the *Vanity* he speaks of, and as the spaces differ in proportion, so doth our several *Ages*.

The next is a *Foot*, *T. Fusz*, *L. Pes*, and though this natural *Foot* is an uncertain Measure, yet it retains its name, by a certain new Measure, called a *Foot-Rule*; and as to the first, I may say, that that *Foot* hath some *Anology* with *David's Span*; for by the *Span* the length of our Race is adjusted, and by the *Foot* that Race is to be run.

My next consideration is of a *Cubit*, which is accounted from the *Elbow* to the end of the middle *Finger*. *T. Cubit*. *L. Cubitus*, and the same word *Cubitus* also signifies a *Couch* or *Bed*, telling us, That before our Race is run, we grow weary, lay down on our *Cubit* (or *Couch*) to ease our *Limbs*, where we lean on our *brachial Cubit* or *Elbow*, and commit our *Heads* to be supported by our *Span*, or handle of our *Cubit*, and then we consider of our *abillity* or *disabillity*, in getting to the End of our *measure* of application, and the *Divine Prize* of our *Race* proposed to us.

Next for the *mensura capacitatis*, it consisted only of the contraction of the *palm* of the *Hand*, which was originally thought sufficient to hold so much as might quench the *Thirst* of *Nature*.

But when by excess we forsook the proportion of our first *Constitutions*, *Frames* and *Pugils*, some having *Fingers*, *Hands* and *Spans*, more than treble to the common *length*, and also their *Feet* a *Cubit* long (as *Pliny* tells us) and of the *Sciopides* (which *Munster* speaks of) that one *Foot* sheltered their whole *Body* against the *sun*, whereby in process of time, almost all  
Men

Men and Women became disproportionate to that perfect proportion (which I have mentioned in my *Volatiles* on *Adam*, from *Paulus Lovatius*) it was time to make some certain Measure both of *Application* and *Capacity*, lest the large gripple *Hand*, should take away all from the lesser, and justify it from its large *Dimensions*, and therefore much to the Honour of the *Botanists* and *Galenists*; the *Standard* of measures was made from the *Barley-Corn*, which is so Noble a *Plant*, that it is observed (whether it grows upon a *fertile* or *steril* Soyl, yet) it continues one constant proportion of Measure (though it may differ in weight) and of these, three in length or six in breadth do make an *Inch*, which the *T.* calls *ein dannim breit*, or the bredth of the *Thumb*, but in *Latine* the word is *Uncia*, which they apply both to an *Inch* of *Application* and to the *Ounce* of *Ponderosity*, still making the *Grains* of *Barly* or *Wheat* their Judges, both in *measure* and *weights*: now this *Uncia* or *Inch* of *Application* (as *Arrius Montanus* saith) consists of the breadth of *six Barly Corns*, thereby making bredth to have a Priority to length) but the later *Writers*, more properly make three *Barly Corns* in length, to be the length of an *Inch*, and twelve *Inches* of a *Foot*, and for Measure of *Ponderosity*, those who are for the *Troy Weight*, make twenty four full *Grains* of *Wheat*, and twenty penny *Weights* to be an *Ounce*, and twelve *Ounces* a *Pound*, which complies with the measure of *Application* (or 12 *Inches* to the *Foot*) and this weight is used for *Gold* and *Silver*, &c. but others who are for *Aver-de-poise* weight allow 20 *grains* of *Wheat* to make a *scruple*, three *scruples* a *dram*, and 16 *drams* to an *ounce*, and 16 *ounces* to a *pound*: and these of *Ponderosities* do also comply with the *measure* of *Capacity*; for I compute that a *Pound* of *Troy*, viz. 5760 *grains* of *Wheat* will fill a certain *Vessel* which the *Latines* call *Hemina*, and the *English* (and in most *European Languages* a *Pint* (or *Pinte*) two of which makes a *Quart*, and four a *Pottle*, and eight a *Gallon*, so as the *Pound* of *ponderosity* and the *Pint* of *Capacity* are

are both equal, and this agrees also with the Measure of *Application*, for a foot square (on a cubical account, makes 144 Inches, so that for every one of the 144 Inches, 40 grains of *Barley* being allowed (as the just proportions of Capacity) it amounts also to 5760.

Now as (I have shewn) that the Latines do apply the same word *Uncia*, both to an *Inch* of Measure, and to an *Ounce* of Weight (and, it may be, for the Reason which I have given) so they apply the word *Ulna* to a *Yard*, *Ell* and *Fathom* in Measures (and so by *Dictionaries* jumbled together) whereby the genuine proportions of those Measures are confounded; whereas a *Yard*, in *T. Girte*, and *L. Verda*, is applicable to any *Rod* or *Stick*, that is not appropriated to any certain rule of *Dimension*; but as *Ulna* or *Yard* is fixt to a certainty, it signifies the length of 3 *Feet*, or 36 *Inches*; and an *Ell*, *T. Ellen*, and *A. Ell*, from *Elbow* (or *Ell-bone*, because from that bone to the top of the middle *Finger*, is accounted a *Cubit* or a *Foot* and half) so 2 of those *Cubits* makes a *Yard*, and 3 *Foot* and 9 *Inches* makes our *Ell*, and a *Fathom*, which is a Measure used about sinking our *Mines* (called also *Ulna*) is two *Yards*: I might mention many more Measures of *Application*, used both above and under Ground, for the guiding and working of *Mines*, as also of other Measures of *Capacity*, as *Furnaces*, *Ovens*, *Pots*, *Pans*, &c. used for *Metals*: but I must not run too far upon this copious Subject; yet because the *Ells* length, and other Measures (which I have named) are often mentioned by *Erckern*, and knowing that one *Ell English* is two *German Ells*, and the like of many other Measures; I intend this at first, only as a *Caution* to *Affayers*, &c. in making *Furnaces* or *Instruments*, according to the *German* or *English* proportions; which must be left to their *Ingenuity* to judge, what lengths or breadths are best suiting to their *Operations*.

MEDALLS. *T. Schraw grochen*, *L. Sigillum fusile*, that is, a piece of cast *Gold* or *Silver*, wherein some observable thing is represented, and is given by *Princes*, as *Memori-*

als of *Virtue*, or notable *Accidents*, and are accounted rather gratifying *Presents* than currant *Coyns*, and the word signifies also *Counters*, or something impress'd on them, worthy of our account.

MELTER. *T. Schmeltzer. L. Fusor*, and by our *English, Mine-Workers*, (as at *Consumlock* and *Tallibant, &c.* in *Wales*) where they still retain the words *Smelter* and *Smelting*, which was brought into us i. *Q. Eliz.* by one *Hosetter* a *German*; but in *fining* the *Metals* (after they are *smelted*) for distinction, the work is called *melting* and *remelting*, or *fining* and *refining*, see *Alchimiſt, Metals, Utenſils*.

MENSTRUUM, which we *Translate* *Flowers*, and define them to be *Purgatio frigidi & indigesti humoris quem natura quasi noxium ejicit*; now the word *Menstruum* as it relates to the *Female Sex*, (of which you may read in *Pliny, l. 7. c. 15.* is pernicious: but our *Menstruum* relates only to *Metalls* (which are all seven of the *Neuter Gender*) and the *menstrual* parts of them, do afford many great *vertues* and excellent *medicines*, and is the most sublime part of the *Scoria's* of *metalls*, and therefore also called *Flowers*, from its nature of *flowing* and shewing it self on the top or corners of the *Vessells*, where it usually resides.

MERCURY. see *Metalls, Mineralls* and *Quickſilver*.

METALS, *T. Metal* and *Ertz* and the *Metal-Worker Berck-hawer* and *Berck-werk* from *Berg, mons*: (wherein they are generally found) and *Werk, Opus*: and the Latin *Metallum* and *Metallarius, A. Miner*; the kinds of *Metals* are accounted seven viz. *Gold, Silver, Copper, Iron, Lead, Tin* and *Quickſilver*, which I treat of in their *Alphabetical Discourses*: But as a *Deputy Governour* for the *Mines Royal* in *England* and *Wales*, I must acquaint you,

That, 1. as for *Gold*, (we have it not in *sands* as in *Africa* or *America*) or so intermixt with other *Minerals*, that it will requite the charge of *Separation*, and yet upon information of two *Mines* (one at *Pullox-hill* in *Bedfordshire*, and another in

little

little *Tawnton* in *Glocestershire*) which, as was pretended, contained a great quantity of Gold in the *Oar*, we granted two distinct *Leases*; but they proved not at all successful: 'tis true, that among the *Tin-Mines* in *Cornwall*, they find little pieces of *Gold*, and seldom above the worth of 10 s. But this, as they dig for *Metal*, not in the *Metal*.

2. As for *Silver*, we have none, but intermixt with other Metals, especially in *Lead*; And in the time of the late Wars, Mr. *Bushel* set up Mills at the *Mines* in *Cardiganshire*, and made out of those *Lead-Mines* 20 l. of *Silver* out of every Tun of *Lead*: and at *Shrewsbury*, a *Mint* by his Majesties Permission was set up, and then coined so much as paid that part of his Army, but it doth not now answer the Expence, or at least the knowledge of it is kept from us: and I am confident we have several *Lead-Mines* in *England* which would yield in every Tun, from 20 l. to 80 l. of clear *Silver*, and why this is not put in practise, I shall hereafter disclose.

3. Of *Copper* we have very good and plentiful; See the word *Copper*; and why those also are not wrought, I shall say more hereafter.

4. *Iron* is not in our *Patent*, only *Iron-Wire*, for the making of which, we have Mills at *Tinturn* in *Monmouthshire*; See more in Word *Wire*.

5. Of *Lead* We have the Government both in *England*, *Wales* and part of *Ireland* (except the *Lead-mines* at *Dovegang*, in *Darbyshire*, and at *Mendyp* in *Somersetshire*; and also all other Mines that do not hold *Gold* or *Silver*, because in those two places, and some others, the *Lead* is look'd upon to be so poor that no *Silver* can be extracted from them, or at least, not proportionable to the charge of *fining*, &c. of which you may see more in my Book called *Ædina Regalis*.

6. Of *Tin*, we have also the Power of *Inspecting* them in all *Mines*, (except *Cornwall*, where they are managed by a peculiar Court, called the *Stammeries* from *Stannum*, the L. for *Tin*, of which you may see more fully in *Cambdens Britania*, p. 185.)  
and

and for other *Tin-Mines* none do venture on them, because of the great Product of *Cornish-Mines*.

7. Of *Quick silver* we have very little or none in our *Mines*, so as we are forc'd to have it from beyond Seas, for which reason, whatever others account of this, as the seventh Metal, we cannot, because it is not our *Native Metal*, and therefore we may rather chuse *Antimony*, of which we have plenty; or *Brass*, of which we may make sufficient for our selves and Neighbours.

And there is another *Metal* which *Pliny* makes the seventh Metal, by the name of *Electrum*, containing upon dissolution the fourth part of *Gold*, and a fifth of *Silver*; but we have none such, yet such a thing is mentioned in *Holy Writ*: see *Fodina Regales*.

And as for *Gems*, we often find in our *English Mines*, *Sapphirs*, *Amethists*, &c. but very imperfect, for want of a stronger heat, as in hotter Countries, and about *Bristol* in the *Callamine Hills*, there are plenty of such *Stones* which imitate *Diamonds*, where I had the luck to find one of a good value, which I caused to be cut and set, and yielded a fine splendor.

**MINERALLS. T. & A. L. Mineralia**; these are *Metals* of a middle nature, between the 7 *Metals* and *Stones*; of which sort, *Erckern* mentions these; *Allum*, *Antimony* or *Stibium*, *Armoniack*, *Arsnick*, *Brimstone*, *sulphur*, *Calaminaris*, *Cinabar*, *Talk*, *Vitriol*, *Nitre*, *Orpiment*, *sandover*, &c. which I treat of also distinctly, in their *Alphabetical Discourses*; but of all these we have so great plenty in *England* and *Wales*, that we need not have recourse to Foreign parts for them, only in those Countries where the *Metals* are not, I do not find any of these, or scarce any other *Mineral*, for it seems they are of a friendly nature not to part.

*Mines*, *Ertz-Grub*, from *Ertz-metallum* and *Grub fodere*: (which Word *Grub* we still retain in *England* in the same sense) *L. minera*, which relates to places in the Earth, where *Metals* or *Minerals* are found, and I conceive the word *Mine*



is no other than a translation of *Mens*, which the *Belgicks* write *Miine*, and the *T. Mein*, and *A. Mine*, so as doubtless they have all this sense; that, that *Metal* or *Mineral*, which I find in the *Earth* is *Mine* (*Proprio fure salvo Rege*) and this is still a custom at *Mendip*, and at the *Dovegang* before mentioned) however altered in other places; but here it only signifies the place or *Bed*, where the *Metal* or *Mineral* is lodged (without relation to the *Proprietor*) and they who dig for them are called *Miners*, it may be from *Minores*, being a People of lesser Quality than those above ground, so that in the *Romans* time, they were *Slaves*, or such as for *Offences*, were (instead of other *Punishments* condemned to the *Mines* (*Goodwin's Ant.*)      See Alchimiſt.

Whilst I was writing this, a Friend of mine came to me, and seeing me intent about this Book, ask't me why I left some other Subjects about *Parliaments*, &c. of which I Published but some parts, and others were expected? I told him, that I had not the opportunity of seeing *Records*, as I formerly had, and so did betake my self to this of *Metalls*, being far more pleasant, in respect it consisted of greater varieties than any one of the *Liberal Sciences* or *Arts*, and withal added, That there is a certain *Chain* in all our *Affairs*, by which we are *invisibly guided*, of which the *Story* of *Joseph* (sold for a *Slave*, yet proved a *reliever* of those who *inſlaved* him) is significant, and though that *Story* doth not *quadrate* in all *Mens Actions*, to have the like *success*; yet in this, to me it doth; for even those *Notions* which I had of this *Subject*, which began with some *dangerous Attempts* (as I shall shew) have continued in my mind by *accidental Occasions* and *Employments*, till this very time, that by them I now find my self full of *content* and *happiness*, in the *Divine* and *Humane Contemplations* of them and their *circumstances*; and now, Sir, said I, give me leave to begin with the first link of this *Influential Chain*, which is held at both ends, by the Hand of *Divine Providence*.

Whilst I was a small Student of *Pembroke Hall* in *Cambridge*,

[Z]

bridge, my good Mother (then a Widdow) consulted with Sir Tho. Bendish (a near Neighbour, and related to her) how I might spend the *Summer Vacations* to Improve my self, and thereby keep me from other *inconveniencies*, which usually attend *Youth* (being then 17 years of Age, and of that *University* 3 years) Sir Thomas (who was a Practical Master of most *Sciences*, and insighted into all, and afterward *Embassador* to *Turky*, whose *Transactions* there, for 14 or 15 years, deserves a particular *History* (which in *Gratitude* I shall endeavor to perform) replied, *Madam* (said he) if you please to intrust your only Son with me, I will my self accompany him for two Months every year, till we have seen the *chief Varieties* which *England* affords, that he may be the better accomplish't for *Foreign Travels*; this favour was kindly accepted, so in three *Summers* more (before I left the *University*) he did perform what he promis'd, and the first Summer, our first *Gess* led us through *Darbishire*, which affords more pleasing *Objects* of *Art* and *Nature*, than any County of *England*; but I shall speak only of such things, as relate to the *subject* of this *Book*, and of my *entrance* into the concern of *Metals*; the *Theory* of which, with other *Rudiments*, my *Tutor*, Mr. *Boswel* (Brother to the *Boswel* that was then *Resient* at the *Hague*) had imprest in my thoughts; but as to the inducing *Practicks*, we spy'd several *Wells* near the *Roads* over the *Dovegang* (which abound with the poorer sort of *Lead Mines*) so we rode up to know the uses of them, and we were answered, That they were not called *Wells* but *Shafts* like *Wells*, only *shafts* were square, and common *Wells* round, one made of *Wood* and *Timber*, the other usually of *Stone* or *Brick*, and whilst we were speaking, a *Basket* of *Lead-Oar* was drawn up (as our *Buckets* are to our *Wells*) I ask't, whether I might be safely let down in the *Basket* to see their *Works*? they assured me I might, and so with Sir *Thomas's* consent (who in respect of his *Corpulency* thought not fit to lead the way) I was let down (not in the *Basket*) but by a strong stick, laid cross the *Hook* of the *Rope*,

I fate on it between my Legs, one hand holding the *Rope*, the other guiding me from grating on the sides ; so soon as I was down (being about 24 Fathom, or 48 Yards) the *Labourer* that waited for the *Basket*, was quickly informed of my intents, who presently, at my request (promising Reward) fetch't two Candles lighted, by which I saw, that there was no other passage than what I came down in, and by what I was to go into the *Mine*, but by that time we had gone half way, I told my *Conductor*, that I could not keep my Candle light, and at the same instant both Candles went out ; Sir said he, *I pray stay here, and I will go fetch more Candles, for it is nothing but a damp* ; at which words, my Spirits were much discompos'd, yet I had so much left as to crawl back to the Shaft, and suck't in as much Air as relieved me ; my *Conductor* soon returned with more attendents to light me, but I was very unwilling to return again, but gave them liberally something to drink, which the more oblig'd them to perswade me to see their Works, assuring me, That those Damps were not killing, but they had taken care (by keeping open the passage of their Waters) that no such Accidents should happen while I was there, and that they had good *Aqua Vita*, *Rosa solis*, and good *Ale* to cheer me ; with that, I went to the *Mine*, where their constant *Lamps* and *Candles*, which they lighted for my sake, did make the glitterings of the *Oar* very pleasant to me, by which I also savv their method of *Digging*, and vvas vvell treated vwith their promised *Drinks*, besides good *Beef* and *Bread*, so as their *liberality* encreas'd mine, and then I vvas attended to the *Shaft*, and so dravvn up as I vvent dovvn, and in my gentle passage, I thought of *Virgil's Distick*,

Eglog.  
3. *Dic quibus in Terris, & eris mihi magnus Apollo,  
Tres Patiat Cæli spatium non amplius ulnas.*

But I vvas not Edified by it, and so I came safe up, and gave a pleasing account to Sir *T. Bendish*.

From thence vve vvent to *Eldon Hole*, (being on the top

top of the highest Hill, in the *Peak-Forest*, which we computed to be above an 150 yards long, and more than an 100 broad, the bottom (as 'twas told us) not to be fathomed; and by prying, I had certainly fallen into it (for the ground is slippery) if I had not been caught hold of.

But Sir *Thomas* espying some work-men making of Walls, (for there and in other stony Countreys, they make their Inclosures of loose stones (or slates) in stead of which in *Suffolk*, *Norfolk*, &c. they make Ditches, and plant them with *Quicksets*, on the sides of the banks, but in *Devonshire*, &c. they use high Mounds of *Earth* and *flag*, and plant them on the very top of the Mounds, and both are beneficial Fences by their Products, (whereas those walls affords none) but he resolving to try some experiment did ride to them, and by our generous Promises, perswaded three of them, with their *Pick-axes* and *Tools*, to mount behind us, to the Hole; where first, they dig'd a pretty large stone, which we tumbled in, and the noise of its motion pleased us: then they dig'd a second stone, as much as six of us could well roul in (for the mouth of the hole was declining) and presently laid our ears to the ground, and we could tell eight score distinctly, before the noise of its motion ceased, and then to our apprehensions, it seemed to plunge it self into water; and so we tryed a third stone, of more than the former Magnitude, with the like Observations, which pleased the Labourers (with the Addition of our Gratuity.)

From thence we went to *Buxton's Wells*, bath'd our selves that night, and the next morning (of which I shall speak more in the word *Waters*.) we went to the *Devils Arse of Peak*, (saying your Reverence, as the learned Mr. *Cambden* expresseth his Civilities) where we saw a large hole, in the bottom of a steep hill, on the top of which stood an antient decay'd *Castle* (of which you may read more in his *Britania*) We had Candles, and saw as much as we could, till we were hindered by running *Streams*. Now of these two *Holes*, there are many *fabulous* stories; but some years after, upon viewing  
other

other Mines, and their *shafts* and *Audits* to them, I apprehended that this *Eldon-hole* vvas an antient *Shaft* (made in the *Romans* time) to a *Mine*, and that the *Devils arse* was the Mouth of an *Audit* to that *Mine*, and I am the rather of that Opinion, because I conceive, That the *Level* of the *Water* (vvhich stopp our further passage into that *Audit*, *Arse* or *Fundament* of the *Mine*) is level with the *Water* at the bottom of *Eldon-Hole*, and the word *Arse* may be applyed upon two accounts, first that upon a Mistake of the word *Arse*, for the Latine word *Ars* or *Art*, where the *Romans*, when they brought out their *Oars* of Lead, and probably made *Silver* of it, and did thereby shew their *Ars Metallica*, which the *British* not being latiniz'd cal'd *Ars*, and as an Art which they did not understand, they (as the *Vulgar* do yet) attribute it to the *Devil*, and so call'd the *Devils Arse* or *Ars diabolica*; (as we see in the *Weapon Salve* or *Sympathy Ponder*, the knowledg of which two great *Secrets* were attributed to the *Devil*, as we may see by *Godelmanus*, and other Books, till they were convinc'd of their *Error*: or it might come from *Arce* the *Ablative* of *Arx*, Latine for a *Castle*, and probably this *Castle* was originally built to protect the *Treasure* which came out of the *Hole* under it, or to keep the *Miners* in aw (there being the like *Castle* at the *Roman Mines* on the *Darren Hills* in *Wales*) and possibly the Governour of it being severe in his *Duty*, the *Vulgar* (as they are apt to do in any regular Government) might call him, and it, *Diaboli Arx*, and since opprobriously the *Devils Arse*, but I have said enough as an *Apology* for the *Word*, and for my *Opinions* therein.

I conceive they are not so fabulous as those which are told in the *Country* about these two *Holes*.

Here my Friend interrupted me, and ask'd how *Eldon Hole*, (from the usual proportion of a *Shaft*) came to be so large as I described it; I answered, That *Gutta cavat lapidem*; and if one drop by often cadency will make a hole in a stone, it is easy to be credited, That the fall of Clouds of *Waters*, (from the

time that this was a *Shaft*, being about 2000 years) might well widen it, from *Virgil's* dimension of 3 *ulna's*, yards or *ells* square; (for I conceive he meant the *Shaft* of a *Mine*) to this great *Dimention*, at which he smiled: and so I went on; Sir, said I, the next two Summers, we made a further *Insight* to several *mines* & *Carves*, with no little danger (which I refer to other *Discourses*) and also their several wayes in their operations at those *Mines*.

Some few years after, the Wars came on, where my *Speculations* were improv'd by the information I had at *Oxford*, that the *Royal Mines* in *Wales* were very helpful to his late *Majesty* during those *Civil Wars* (as I have shewn.) And, after the Wars viz. 1650. telling these *Stories* to Mr. *W. B.* he told me, He had a share in the Society for the *Mines Royal*, and desired to transferre it to me, in trust, which I accepted; and did execute it, for near 10 years after; and then resign'd it, but the *Societys* finding my *Diligence*, and *Insight* into that *Affair*, were pleased to bestow two quarter parts on me to continue me, and as a *Testimony* of my *Gratitude*, in *Anno* 1670, I writ a Book of their *Priviledges* and *Rules*, which I called *Fodinae Regales*, and dedicated it to them, with a promise to proceed in the publishing of *Erckern*, which now I have done, and some other pieces which I hope to do.

And thus, Sir, said I to my Friend, I have given you an *Account* of several *Links* of this *Chain*, which guided me into this *Laborinth* of *Metals*: But to get out of it, that which I aim at, is to write a little more of their *Products*, and to offer some *Expedient* how the *Mines* may be made more profitable to his *Majesty*, and to other *Proprietors*, with some *Advantages* to the *societies*, which, God willing, I shall perform in due time, and then we parted, he wishing me good *Success* to my *Endeavours*.

And so I went on, where I left, namely to Acquaint the *Reader*, that *Erckern* doth tell us of several *Mines* in *Germany*, p. 28. especially in *Austria*, p. 285. *Bohemia*, *Belgia*, & *Flanders*, p. 170. *Hungary*, p. 103. and *Saxony*, p. 77. he also

so

so mentions the particular Cities and Villages to which they belong, and where they are refined *viz.* at *Brussels*, p. 170. *Cracow*, p. 208. *Cuttenburgh*, p. 142. *Friburgh*, p. 6. *Gal-may*, p. 285. *Goslar*, p. 78. *Hessen*, p. 285. *Holland* p. 170. *Joakims-Valley*, p. 34. *Islenburgh*, p. 285. *Causingen*, p. 285. *Knien*, p. 100, (where he saith the *Mines* contain good *Duke-Gold*) *Lickbeter*, *Manhren*, p. 4. *Meichsen*, p. 4. *Misnia*, p. 6. *Norimberg*, p. 86. *Saxen*, p. 4. *Schwath slackenward*, p. 83. *Shesron*, p. 4. *Sorath*, *Suevia*, p. 285. and *Suabem* --- *Tyrol*, p. 285. *Villach*, and *Waldenburg*, and many other places which he and *Geographers* do mention (See *Heylen*) and therefore I think fit also to mention the Counties of *England* & *Wales* wherein *Royal Mines* have been discover'd to us, *viz.* in *Bedfordshire*, *Cheshire*, *Cornwal*, *Cumberland*, *Darbyshire*, *Devonshire*, *Dorsetshire*, *Durham*, *Essex*, *Glocestershire*, *Herefordshire*, *Kent*, *Lancashire*, *Monmothshire*, *Notinghamshire*, *Northumberland*, *Rutlandshire*, *Sbropshire*, *Somersetshire*, *Staffordshire*, *Sussex*, *Warwickshire*, *Westmorland*, *Worcestershire*, *Yorkshire*, and in all the twelve Counties of *Wales*, so as of the 52 Counties there are 38 of them *Metallick Counties*, but in many of the rest, *viz.* *Barkshire*, *Buckinghamshire*, *Cambridgeshire*, *Hampshire*, *Hartfordshire*, *Huntingtonshire*, *Leicestershire*, *Lincolnshire*, *Middlesex*, *Norfolk*, *Northamptonshire*, *Oxfordshire*, *Suffolk*, *Surry*, *Wiltshire* there are good *Minerals*, but in some of them neither *Metal*, *Mineral* or good *Quarries*, and yet they are recompenced some other ways.

Now, though *Germany* abounds in *Metals* and *Minerals*, yet *Erckern* acknowledgeth that they have a better sort of *Copper* and *Lead* from the *Mines* in *Poland* (as it seems p. 268.) and a better sort of *Gold* from *Hungary*, p. 108. *India* and *Æthiopia*, p. 101. and a better sort of *Lapis Calaminaris*, (and other good *Oars* of *Metal*) from *England* (which *Erckern* calls *Britain*, p. 286. and a better sort of *Soap*, to contemper *Metals*, from *Venice*, than their own, so though we have as good

*Mines*

*Mines in England*, yet we are forc'd (for want of a constant use of them, and thereby improve our *Knowledg*) to borrow the Products of their *Mines*, and indeed our chief *Knowledg* how to work them (as I find by our *Records*) and they may well have greater Experience than our selves, because *Erckern* tells us, That the Mine at *Goslar*, formerly under the D. of *Saxony*, but now under the D. of *Brunswick*, hath been in constant working for above 700 years, to his time: and *Heylen* tells us, That the D. of *Saxony's* Mines, (the Territories not so big as *England*) yields to him above 130000 *l.* yearly; now why ours are not made so beneficial to us: I attribute it either to Reasons of *state*, or want of *Knowing* the several *Arts* which belong to the *Working* of them.

MINT, T. *Muntz*, vel locum ubi monetam cuditur, L. *Monetarium*, *Officina monetaria*, *Taberna monetaria*, *Officina Cusoria*, A. it signifies vwith us, (as *Cowel* renders it) the place vwhere the the *King's* Coyn is formed, be it *Gold* or *Silver*, which is at this present, and long hath been, in the *Tower* of *London*, though it appear by divers *Stories*, and other *Antiquities*, that in antient time the *Mint* vvas at *Callis*, *Ann. 21 R. 2. cap. 6.* and *An. 9. H. 5. stat. 5. cap. 5.* the Officers belonging to the *Mint*, have not been alvvayes alike: at this present they seem to be these; the *Warden*, vwho is chief of the rest, and is by his Office to receive the *Gold* or *Silver* of the *Goldsmiths*, and to pay them for it, and over-see all the rest belonging to this Function (his *Fee* is an hundred pounds per *Annum*;) the *Master-Worker*, who receiveth the *Gold* or *Silver* from the *Warden*, causeth it to be melted, and delivers it to the *Monyers*, and taketh it from them again, when it is made (his *Allowance* is not any set *Fee*, but according to the pound weight :) the third is the *Controller*, who is to see that the *Money* be made to the just *Assize*, to over-see the *Officers* and *Control* them, if the *Mony* be not as it ought to be. (his *Fee* is one hundred Marks per *Annum*;) then the *Master of the Assay*, who weigheth the *Gold* or *Silver*, and see-



feeth whether it be according to *Standard* (his Yearly *Fee* is also one hundred Marks:) then the *Auditor* to take the *Accompts*; and make them up (*Auditor-like*;) next the *Surveyor* of the melting; who is to see the *Gold* or *Silver* cast out, and not to be altered after it is delivered to the *Melter*, which is after the *Assay-Master* hath made trial of it; then the *Clerk* of the *Irons*, who seeth that the *Irons* be clean and fit to work with; next the *Graver*, who *Engraveth* the *stamps* for the *Moneys*; then the *Smiters* of *Irons*, who (after they be *Engraven*) smiteth them upon the *Money*; next the *Melters* that melt the *Bullion* (that is, *Gold* or *silver* in the *Mass* or *Billot*) before it come to the *Assaying* or *Coyning*; then the *Blanchers*, that do *aneal*, *boyl* and *cleanse* the *Money* (reducing it to its natural colour, *viz.* to *yellow* if *Gold*, and to *white* if *Silver*;) next the *Porter* that keepeth the *Gate* of the *Mint*; then the *Provoost* of the *Mint*, who is to provide for all the *Monyers*, and to over-see them: lastly, the *Monyers*, who are some to *sheer* or *clip* the *Money*, some to *forge* it, some to *beat* it abroad, some to *round* it, and others to *stamp* or *coyn* it (their *Wages* is not by the *Day* or *Year*, but uncertain, according to the weight of the *Money Coyned* by them:) Other Officers have been in former times, now useles, because *Mills* are used for that purpose, and the *Art* of *Mintage* and *Assaying* of *Metals* is much improved, by his Majesties great *skill* and *insight* into that *Affair*. See *Coin*, &c.

Now it seems by *Cowel*, That *Mints* were erected in most parts of *England*, but he mentions no particulars, except *Cumberland*, *Northumberland* and *London*, (see his Title *Moniers*) yet under the word *Mint*, he cites the 21. of *R. 2. c. 16.* and 9. of *H. 5. c. 5.* in which two Kings Reigns, the *Mint* was removed to *Callis*, being then under the *English Jurisdiction*; and I do not find it, either before or since, removed from the *Tower* of *London*, except in the late *Usurpation*, and then his Majesty caused one to be Erected at *Shrewsbury*, to *Coyn* the

*Silver* which was brought thither from the *Mines* in *Wales* (of which I have spoken before.)

**MISPICKLE.** T. *Mispickle*; I know no other word for it, being mentioned as a kind of *Oar*, distinct from others (*l. 1. c. 2. f. 11. and l. 3. c. 1. f. 6.*) but it may be derived from the next word *Missy*. See *Oars*.

**MISSY.** T. *Missy*. A. & L. *Misy*. which *G. Agricola* from *Pliny*, calls *Atramentum sutorium*, or *Shoe-makers Black*; but *Pliny* makes it a kind of *Vitriol*, and is confessed to be a *mineral*, and the *Oar* sparkling like *Gold*; so as I conceive *Mispickle* is an *Oar* of the same nature, only spotted; which the T. calls *spickled*, A. *speckled*: so it is a kind of *Missy-Oar speckled*.

**MONEY.** T. *Muntz*. L. *Moneta, Pecunia*, &c. see *Coyn, Metals, Measures and Weights*; and this *Money* is proportioned from 20 *Grains* of *Barly Corns*, which make a *scruple* (according to *Physicians terms*) or a *Penny* according to *metallick terms*; and 20 pennyes make an *Ounce*, and 12 *Ounces* (either of *Gold* or *silver*) makes a *pound* (according to the *Trojan* computation, and thence called *Troy Weight*;) as for *Haver du-poise* weight, or *Haver weight*, it hath 16 *Ounces* to the *Pound*, and *Metals* and *Gems* are not concerned with it: however, the *Barly-Corn* bears the sway in both; so the poor products of the superficies of the *Earth*, seems to give *Laws* to all our *subterranean Treasures*, both before, and when it is made *passable*, and *communicable* or *currant Money*; whereby I conjecture, that the word *sterling Money*, may not improperly be derived from *Sterilis*, or *natural unfructified Ground* (which is proper for *Barly*) whereas *fertil, dung'd, or artificial Grounds*, makes it more *ponderous*, and its *Grains* not of so true a *standard* for *sterling Money*, as those of a more *Natural Earth*.

Now to all *Silver* or *Gold Money*, there is an *Allay*; that is, a taking away part of the *fine Metal*, and adding the like part of the *baser*; that is of *Copper*, &c. and this is done upon two accounts: first, that the *baser Metal* may make the *finer* to be  
more

more apt for *Coynage*: the other is, that the *Sovereign* of that *Government* where it is so *allay'd*, may by the *deduction* or *allay*, be paid the full charge for the *Coynage* or *Minting* of it: Now the less *allay* that is put to the *Coyned Gold* or *Silver*, doth render the *Government* the more *Honourable*, and the *Sovereignty* of a greater *Esteem*, than in other parts, where they have greater *allay* (*Vaughan.*)

It is good for a *Traveller* to be skillful in the different *allays*, whereby, as a *Friend* of mine told me, That he carried out an 100 *l.* with him, and with his art of *Exchanges*, in *Countrys* where *allays* differ'd, he bore his *Changes* of *Travel*, and brought his *stock* home again; however, this *Mony* thus *allayed*, is called *Coyn*, when the *Sovereign Stamp* is upon it (which is a *Legal Stamp*) and every *Sovereignty* useth a different *Stamp*, as here in *England*, and in the *Empire*, *France*, *Spain*, &c. proper to its *Sovereignty*; and every piece of *money* so *stamp'd*, hath almost a different *allay*: yet all *Princes* do agree in severe, yet just, *Penalties*, for *Counterfeiting* *allays* or *stamps*, and make it, as in *England*, *High Treason*. vid. *Coke*. 2. In. p. 575.

MONYERS. see *Money*, lately called *Bankers*.

MORTAR. T. *Gips*. L. *Gibsum*, made of *Water*, *Calx viva*, *Lime* and *Sand*, and used in all sorts of *Structures*, to cement *Bricks* or *Stones*. See *Calx* and *Sand*.

MORTER. T. *Morsell*, *Morsner*. L. *Mortarium*, which *Minshaw* says, is *morte earum rerum quæ in illo teruntur*, and though we write one with an *A*. the other with an *E*. for distinction, yet the *Beaters* for that, and *Pestles* for this, makes *Minshaws* discription serve for both of them. See *Sand* and *Pestle* and *Sculp.* II. and IX.

MOULD. T. *Model*. L. *Modulus*. A. *Frames*, &c. See *Utenfils*.

MULLET, T. *Mallen* & *schleifer*, L. *Molaris*, *marmoris*, a little flat piece of *marble stone* on vvhich *Painters* grind their *Colours*, and *Metallists* their *Metal* to dust, from *molare* to distinguish it from the *Mullet* fish.

MUNK,

MUNK, T. *Munich*, which I conceive, comes from the L. *Munitus* (and not from *Monicha*) as an *Instrument* that guards and strengthens the Operation of *Metals*, by covering it from the Air, and therefore though A. write it *munk*, it were more proper to be writ *munt*, as an abbreviation of *munitus*.

N E



N E

NEALING or *Anealing*, T. *Abgeadnet*. I find it not in our Dictionary, but in *Cotgrave* it is *Nellenre*, and signifies a *vernishing* and *enameling*: the difference is in the Arts; that *enameling* is upon solid Bodies, as *Gold*, *Silver*, &c. but *anealing* is usually apply'd to the coloring of *Glass*, such as we had in former times, and still have in Church Windows, in excellent Varieties, and sometimes 'tis used for *tinging* or *coloring* of *Stones*, where it is done by *fire*, but here the word is applicable only to such *Coppels*, &c. which are covered and *strengthened* with *Clar*, for resisting the fire, and the manner of *anealing* them, is allways done by a *gradual*, and not a *violent* heat. l. 1. c. 10. f. 1. see *Amel* and *Clar*.

NEEDLE, And it is applyed to several things, and hath thereupon several *Names* in several *Languages*, but in *Latine* it is called *Acus* from its *Acuity* or sharp point, (and is sometimes applyed to ingenuous *satyrick* Wits;) the *French* call it *Aquila* quasi *Anquilla* (as *Minsbaw*) because it is proportioned like an *Eel* fish, but the *German* here calls it *Nadeln* from *Naeden* or *Naen*, *suere*, i. e. to sow or stitch together,

ther, and this word *Nadelin* is the nearest to our word *Needle*. Which word being used in the *New Testament*, to shew the difficulty of a Rich man to enter into the Kingdom of Heaven: It stands such men in hand that deal in Metals (in order to make themselves rich) to see how far they are concern'd in the impossibility mentioned in the *Text*, now *St. John* makes no mention of a *Needle*, but *St. Matth.* ca. 19. ver. 24. saith, *It is easier for a Camel to go through the eye of a Needle,* (per foramen acûs transire, *Sept.*) than for a rich man (that is he that abounds in Money, made of metals) to enter into the Kingdom of God; and so *St. Mark*, cap. 10. v. 24. and in *St. Luke* 18. 25. but the Latin is *foramen acûs*, the *Needles eye*, which, my Author (whom, I cannot readily call to mind, or else I should own him) saith, there was a little *Postern Gate* in the *Wall of Jerusalem*, which was called *foramen acûs*, or the *Needles eye*, through which a *Camel* could not pass without *Kneeling* (which saith *Pliny* *Camels* are taught to do) so as by going on their *Knees*, a *Camel* might pass through that *Gate*, which otherwise it could not do; and so the *Story* alludes to a rich and humble man, who by *Humility* may easily enter into the *Kingdom of Heaven*, but not a proud rich man, that will not stoop, but puts more confidence in his money or metals, than in an humble or devout mind, which is imply'd by the bending of the *Knees* of the *Camel*.

Now, this word *Needle* is once only used in the *New Testament*, by those three *Evangelists*, and no more, but it is used oftner in the *Old Testament* to other purposes, and is alwayes joined with the word *work*, as *Needlework*. But in the *Translations of the Oriental Languages*, the *Translators* differ, for *Dr. Walton* in his *Polyglot* renders *Needle-work*, *Opus recamantis*, *Opus Polymatrii*, *Opus Varietoris*, *Opus picturarum*, *Opus Imaginum*, so as there is nothing of a *Needle*, but from the *Chaldee*, and there he translates it *opus acu pictum*, and from the *Arabick* which he renders *Phrigianum*, and *Junius* and *Trimelinus* (published before that *Polyglot*) in every place of the

Old Testament, where the word *Needle-work* is used (as in the 26, 27, 28, 36, 38, and 39 Chapters of *Exodus*, and in the 5th of the *Judges*, and in the 45 *Psal.* ver. 14. for it is used in no other places) do follow the *Chaldee* and *Arabick*, in the words *Opus* and *Artificium*, but not in *acu pictum*, yet the two most eminent *Poets* of their time in *England* and *Scotland* concur'd in the uniting of those words, for *Sandys* writes thus, *Psal.* 45. 14.

*Shee shall unto the King be brought,  
In Robes with Phrygean Needle wrought.      And*

Buchanan

*Dives opum, dives Pictai vestes & auri.*

(where note he useth *Pictai* for *pictæ*, as *Virgil*, *Lucullus*, and other *Latine* Authors do oft change the *Diphthong æ* for *ai*) so that *Sands* hath the *Needle-work* in the word *wrought*, and that he calls *Phrigian* (from *Phrigia*, where it is supposed that *Art* was first taught) answering the *Translation* of the *Arabick*: and *Buchanan*, *Pictæ* answering the *Translation* from the *Chaldee*; and these *Needle-Works* are there also called *feminalia torta*, because the *Art* is mostly used by *Women*, and therefore *Acus* for a *Needle* is properly declin'd in the *femine gender*.

Now, the shape of the *Needle* was taught us by *Nature*, for there is a fish which I have often seen on the *Coast* of *Suffolk*, which commonly comes there with the *Mackerel*, and differs only by having a *snout* of about 12 *Inches* in length, being a firm *bone* in the shape of a *Needle*.

Now, whether this be one of the *Needle fishes* mentioned by *Pliny*, l. 32. and call'd *Acicula* (and one of the 176 *sorts* of *Fishes* which he there enumerates, or the *Acus Aristotelis*, or the *Acus Opiani*, mentioned by *Fonston*, lib. de *Piscibus*, I cannot say; but *Cooper*, from *Pliny* (yet I find it not in *Pliny*)

*Pliny*) describes it just like the *Suffolk Fish*; *Acus*, saith he, is a Fish long, small, and smooth, on the back colored as it were with green and blew, his Beak long and sharp, and makes this of the masculine Gender, and we call it the *Needle fish*.

*Acus* also sometimes signifys an order in *Battle*, and so called *Acus belli*, when they are at point of Fighting; *Acus* also signifys the spiral parts of *Wheat*, *Oates*, *Barly*, &c. being like so many *Needles*, and not chaff, as most *Dictionaries* have it: And there is an herb called *Acus pastoris*, or *Acus moschata* being full of *Prickles* like *Needles*, but vulgarly 'tis call'd *Venus's Comb* or *Charvell*, the chief *Virtue* of which is to provoke *Lust*, and so may be called *Acus libidinis*. There are many other Instruments of this name, *Needle*, which are used by *Carpenters* to cripple, grapple, or joyn houses together, and *Thatchers Needles* to thatch withall, &c.

But the chief Application of this word *Needle* is in *Naviga-tion*, and there called *Acus Navigatoria*, or the *Mariners Needle*, or *Compass*, in respect that he compasseth the Seas, by the *Virtue* which it borrows from the *Loadstone*; (of which I have spoken at large) and is of such a transcendent Nature, that which way soever the ship moves, still the head of the *Needle* fixeth it self to the *North*, and the other point to the *South*, and this admirable Instrument hath no other title in our Language than *Needle*: I hope that none that shall read this long Discourse of *Needles* will think it *needless*: but it was from *Erckern's Touch-needles* which he calls *Streich Nadeln*, and *Agricola, de re Metallica*, calls them sometimes *Gold*, or *Silver* or *Copper Needles*, by the touch of which the worth of each *Metal* may be known, and they differ in the making, forming and shaping of them, as may be seen in *Sculpture* 8. & 18: and in *G. Agricola*, p. 199. which shews them in an *acular* or *Needle-form*.

Now, there being great trouble and nicity in making of them either way (for indeed it is one of the most curious pieces about the *Metallick Chimistry*) therefore the *Chimists*,  
Gold-

*Goldsmiths* or *Tryers* of *Gold* and *Silver* (to save trouble) do make use of a *Touchstone*, being a kind of soft *Marble*, of which you may read more in *Stones*. I read but of one sort of *Needles* more, which *Cambden* speaks of, in his *Britania*, p. 700. viz. of a *Vault* under the Church of *Rippon* where there was a little hole, called *St. Wilfred's Needle*, through which a virtuous *Woman* might pass with ease, but if she were otherwise disposed, she did not pass, but stayed below to be tryed of what *Metal* she was made.

**NILE**, or the River *Nilus*. See *Gold*, *Metal*, *Mine*.

**NITRE**, a light, ruddy, yet white substance, full of holes like a *Spung*, and resembling common *Salt* almost in colour; but quicker of *Taste*, and is mistaken by some for *Salt-Petre*; there is also a *Nitre* which comes out of *Africk*, of a purple Colour, but that which is now commonly sold to us for *Nitre*, is *Salt Petre* refined and candied, and used sometime in stead of *Borax*.

**NOSEL**, } *Utenfils.*  
**NUMBER**, } See { *Arithmetick.*  
**NUT**, } { *Measures.*

O A  O A

**O** A R S. T. *Erkes*. A. and Saxons, *Oar*. Danes, *Aare* and *Aaure*; the L. *Metallum Crudum* (*Skinner*) for I find no single word for it, unless it be *Fodina*, which may be applyed to other dig'd things; but in our *Patents* for the *Mines Royal*, is writ *Emre*, which signifies



fies a place where *Water* is, for *Water* allways attends *Metalls*, and from thence the *Ewres*, which was formerly made of *Silver*, to pour *Water* into Basons, is called *Ewre*; and from thence comes *Sewer*, or one that takes care for drawing of *Water*, where any Land or place hath more than is necessary, but generally in our *Language*, we call that which is digg'd from the *Bed* of any *Metal*, *Oar*; as if one should say *O admirabilia Rerum Metallorum*, for most of our *Monosyllables* are but *abstracts* of many words *compacted* into one, as may be seen in Sir *Edward Coke's Instit.* and other *Learned Etymologers*; also we usually call those *Oares* wherewith *Watermen* Row their *Bats*, aluding to the *pains* and *labour* which is used with the Arms in both *Professions*, by *Digging* and *Rowing*; there is also *Leimster-Oar*, of which I have spoke, under the word *Flocks*: but of the *Metallick Oars*, there are as many sorts of them, as there are *Metalls*: yet I find but four *Latine Words*, and those compounded; viz. *Balluca*, for *Gold Oar*: *Pomphilix*, for *Copper* or *Brass Oar*: *Stricturae*, for *Iron Oar*: and *Plumbago*, for *Lead Oar* (*Holliack*) and therefore *Erckern* sometimes calls the *Products* of *Metalls*, from the *Mines Erks* and *Oars*, and sometimes *Stones*, *Goldt.stein*, for *Gold Erk* or *Oar*: *Silver.stein*, for *silver Erk* or *Oar*: *Kupfer.stein* for *Copper Erk* or *Oar*: *Bley.stein* for *Lead Erk* or *Oar*: *Zein.stein* for *Tin Erk* or *Oar*: *speiz.stein*, for *Quick-silver Erk* or *Oar*: *Ein.stein*, for *Iron Erk* or *Oar*: *slack.stein*, for *Steel Erk* or *Oar*: But I conceive, that when he useth the word *ERK*, it signifies the *OAR* joyned with the *Excrement*, and when *STEIN*, it signifies the *intire Metal*, separate from the first *crude* and *heavy Matter*: Now the *Names* that he gives for *distinction* of *OARS* are these (as they are variously dispersed in his *V. Books*) viz. *Blent Oar*, *Cat-silver Oar*, *Cobolt Oar*, *Copper* and *Coppery Oar*, *Crude Oar*, *Fleaky* or *Flacky Oar*, *Float oar*, *Fresh Oars*, *Glassy Oars*, *Glittering*, *Glistering* and *Glimmering Oars*, *Gold* and *Goldish Oars*; also *white, red, brown, Goldish Oars*; *Grey Flints*, called *Iron-man-Oars* and *gross Oares*;

*Oars*; *horny, hard, harsh Oars, Lazure Oars, Leadish or Lead Oars*; *mild and muddy Oars, Slate-stone Oars, Silver, silvery, spady, sparkling, spelter, spizy and sulphury Oars*; also *Talk, Tinny Oars, Washt and Wolferan Oars*; and many others, which are dispersed in several parts of his V. Books: and some of them discoursed of here also, in their *Alphabetical* order; especially where we retain the same *Apellations* for the like *Oars*, to which the *Reader* is referred.

ORANGE. *Orpiment.* See Colours.

OVEN. T. *Offen.* L. *Furnax*, and the same words are used for *Furnaces*; but *Kilns*, which are a kind of *Ovens*, are called T. *Calk* and L. *Calcaria* and *Furnax*: of the several sorts of these, you may see in the *Sculptures*, in their proper pages: viz. the *Athamor* in page 2. 123. 161. 172. 177. 185. 207. a *Wind Furnace*, p. 2. 56. 200. an open *Furnace*, p. 2. an *Assay-Oven*, used by the ancient *Refiners*, p. 13. an *Assay-Oven*, used by the *Norimbergers*, p. 13. an *Assay-Oven* made of *Tiles*, p. 13. 235. an *Assay-Oven* made of *Potters-Loam*, p. 13. 235. an *Assay-Oven* made of *Armour Plates*; p. 13. 153. a *Granulating Kiln*, p. 56. an oven to burn *Silver*, p. 80. a *Roasting Oven*, p. 112. the *By* or *Side Ovens*, p. 123. 161. 172. 177. 185. *Oven* for *Retorts*, p. 177. a *melting Oven* for *Copper Oars*, p. 248. and others. Now for your assistance in the more fully knowing of these *Furnaces*, you may read *Dr. Salmon's* 5th Book of the *New London Dispensatory*; which I have formerly cited, where from p. 821. to p. 828. he makes 17 several *Furnaces* for several uses, and each of them may also be varied, according to the *Ingenuity* of the *Artist*.

OUNCE. See Weights.

OUTLANDISH. T. *Eintrembling-Auszleanger*, L. *Extranens, Aliigena, Exoticus*, which A. terms *Strangers, Aliens* or *Forraigners*; all intending those who are not of the same *Country*, and those the *Jews* called *Heathens*, and the *Greeks* (according to *Plautus*) *Barbarians*. See *Metallick Country*s.

OX T. *Oches, Rind* and *Rund*. L. *Bos* and *Teriones*,  
quasi

*quasi terra terat* (*Minsbam*) we call a gelt Bull, a Steir or Runt; but the Germans call a Bull ungelt, a Steer; and the Lat. have also a Distinct name, *Taurus*: and A. properly a Bull: so the Ox hath three names, viz. Ox, Steer and Bullock, and these are of the greatest size, and it is called Bullock, or more properly Bullack, because it lacks something which it should have: the lesser sort are called Runts (according to the Teutonick word) viz. Welsh or Scotch Runts, these and the females of this kind have several other names, as *Beeves, Cows, Neat, &c.* in which the metallick Art hath little to do, but with their Blood, Bones, Dung and Tallow, which are employed for several uses about Metals, and their meat for the sustenance of the Artists. *see Blood, Bones, Dung, Tallow.*

OYL, T. *Oele*, L. *Oleum*, and Linseed oyle, T. *Lein-samen*, L. *Linarus*: Which is no other with us than the seed of Flax, which in other Languages is *Line* or *Linnen*: but for the Oyl of Linseed it is well known to all that do paint with oyl, that it hath this Quality, that though it be liquid like other oyls, yet is of a more drying nature than any other Oyl, and therefore the more fit for Metallick Lutings, &c. *lib. 2. cap. 27. sect. 53.*

P A



P A

PAGAMENT. I retain the word, because I find that in Florio's Italian Dictionary, *Pagamento* signifies any kind of Payment, *l. 1. c. 1. f. 1.* which signify any broken pieces of Coin'd Money, which before made good

good *Payments*, and this word we abreviate from *Pagamento*.

**PALE-COLOUR.** T. *Bleich*, L. *Palidus*, and A. *Bleak*, *Bleek* or *pale*. See *Colours*, l. 2. c. 43. f. 1. and we have a word *Pale*, which the T. call *Pkall*, L. *Palus*, used for pieces of wood to *pale in* or *impale* a piece of Ground, or inclose it with *Wood*, as with a *Garment* (from *pallium* an outward *Garment*, which being decayed of its native colour, there usually grows *moss* on it, of a *pale colour*).

**PAPER**, T. *Pappyr*, L. *Papirus* (l. 2. c. 23. f. 3. of which *Pliny* saith, That all civility of this life, and the memorial and mortality also of Men after Death (by which he shews that he was not of the *Sadduces* opinion) consisteth in Paper, which saith he, was made of a Plant, having the name of *Papirus*, and he cites *Varro* to tell us, That the first *Invention* thereof was in the time of *Alexander* the great when he conquered *Ægypt*, and built *Alexandria*, where it was first made; and till then their *Memorials* ever were writ on *stone*, *lead* or *Brass*, &c. and, as I take it, *Josephus* tells us, that upon *Enochs* Pillar of stone, (which remaind to *Moses's* time) were writ those things which were done before the Flood. Also the Ten Commands were writ upon Stone: but for more easy *Portage*, and transmitting the minds of men one to another, *Paper* was invented (as *Pliny* saith) in *Ægypt* from the *Bark* of a Plant, lib. 13. c. 11. and 12. where you may read the several names it had, the first and best sort called *Augusta*, the next *Livia*; &c. and many more sorts of it, and tells you also the manner of making it; and that what they did not use of that Plant for Paper, was imploy'd for making little Boats, and the outward *Rind*, for many uses, especially for Ropes, which makes me think, that the *Withy* tree which grows plentifully in *Worstershire* (of which I have spoke in the word *Coal*) is of the same nature; for this Plant *Papirus* (as *Funcius* saith) was about ten *Cubits* high, and so is the *Withy*, and that *Papirus* grew about *Nilus*, and other waterish places, so doth *Withy*, and that they made ropes of it, and so they do of *Withy*: so that I conceive, the inward  
Bark

Bark may make the like *Paper*, which may be tryed for experiment-fake only; for our *Paper* (made of *Rags* by *Water-Mills*, call'd *Paper Mills*, of which I have seen many in *England*) is much better and more useful with less charge) however, the Knowledge of such antient things are not to be lost, and whatever *Pliny* saith of the *Antiquity* of it, the *Chinists* pretend to the use of *Paper* long before *Alexander*, as a Friend of mine (*Cap. J. Hall*) told me who had been thrice at *China*, and the last time brought me a fair Book, all written in their Language long before that Emperor, and that the leaves were only made of the *Bark* of a *Tree*, but of that he could give no certain Account.

TO PEARCE, or *Pierce*, *T. Booren*, *L. Forare* (*lib. 1. c. 34.*) and we after the *T.* to *Bore*, probably alluding to the *Bore*, who, in rooting up the *Earth* with his *Snout*, doth as it were bore it, for the *Lat.* calls a *Bore*, *Aper*, because he doth *aperire humum*, and so by boring it doth open a passage into *Metals* or other things.

PEEBLES. See *Stones*.

PELLICAN. *T. L. A.* and all from *Pellecanus* (*Sculpture 29. f. 4.*) the *Greek* word signifies *perforare*, or to pierce through; in allusion to the Bird called a *Pelican*, which hath a bended *Bill*, by which, (as 'tis said) when her young ones are poisoned with eating *Serpents*, she picks an hole in her *Brest*, and gives her *Blood* to them, which cures them; and so this Instrument, doth as it were suck the *blood* or *spirits* out of several *Ingredients* (for so *Blood* is composed in *Bodies*) of which the *Aqua fortis* and *Aqua regis* are made, and by those waters both *Gold* and *Silver* are cured of their poisonous natures.

PENDULA, See *Sculpture XI*, these are of two sorts, one hanging constantly in a perpendicular line, the other is in a constant motion, and of a late *Invention* for *Clocks* and *Watches*, and made of *Iron* or *Steel*.

PETREFACTION or *Petrification*, *T. Stein-Dreben*, *L. Petrificatio*, which is nothing else than a making that to be, which before was not, a *Stone*; and this effected by *Art* or

*Nature*, those which are done by *Art* are the *Counterfeits* of *Gems*, as *Rubies*, *Saphirs*, *Emeralds*, &c. and *Counterfeits* of *Gross Stones*, as *Marble* and other common *Stones*: but I speak of such as are done by *Nature*, and those of what I have seen, which I conceive are only performed by a *peculiar Water* ordained for that purpose, as at *Pool's-Hole* in *Darbyshire*, where are great grey *stones*, like our *Free-stones*, made by the cadency of *Water*, and some of those *stones* also *cemented* by *Water*, so as there are two or three large *Arches* of those *stones cemented* by *Water*, and where they were not perfectly joyned; by the light of *Candles*, I could see through one *Arch* to the uppermost, and so they lay promiscuously in the *Vault*, as big as a little *Church*: the lesser *Stones* are in the nature of *Icicles*, but not bright, and so encreased in hardness, length and dimension, according as the *Water* descends on them, so as at the points are drops of *Water* still condensing into *Stone*.

The next which I saw, was at *Oky-Hole*, near *Mindip-Hills* in *Sommerfetshire*, where the nature of that constant dropping, petrefy'd it self into a *Christaline Form*, and so seem'd (by the light of *Candles*, of which I had store) as so many *Christal Icicles*.

After this, I had occasion to Visit *Sir Robert Coke*, at his House called *Durdans*, in *Surry*, now belonging to the Honourable *Earl of Berkly*, where I found an *Artificial Grotto*, made of *Flint Stones*, and looking up to the top, I perceived many little pendent *Stones* like *Icicles*, hanging on the *Arch-Flints*, and calling *Pool's* and *Okey Holes* to mind, I broke off some of them, and found them to be congealed *Stones*, and as the others were of a *Free-Stone* and *Christaline* temper, these were *Flinty* drops of *Water* hanging at the ends, like the other almost congealed *stones*.

These *Observations* I made of *Lapidinous Waters*, condensing themselves from the matter through which they pass.

The next are of the like *Waters* penetrating other *substances*

ces, so *petrefying* them: and one of them is near *Knasborough Castle* in *Yorkshire*, where there is a *Well* which turnes pieces of *Wood* and *Leaves* into *Stone*, and other things of a complying nature: But I had a *Honey-Comb* presented to me from thence, which was made perfect *Stone* by that *Well*, which I the more wonder at, because things of cerasious tempers, are usually *Resistables* to *Water*.

The other is that at *Deepham* in *Norfolk*, there is a *Tree* 13 yards about near the root, and at least 80 Foot high, which bears a flower very pleasing to the *Ey*, and *Smell*. *Sir Tho. Brown* Doctor of *Physick*, eminent for universal knowledg, call'd it while he lived, a *Teasle Tree*, and said, That he never saw but one of them, about the further part of *Germany*, and that many had try'd to *graft* or *inoculate* part of it, but without success. Now at the bottom of this *Tree* there is a *Spring* of the like nature, with that in *Yorkshire* for *Petrefaction*; now, I wish, that a *Graft* might be carryed from thence into *Yorkshire*, and planted near that *petrefying Well*, by which it might be seen whether the *Tree* gave any such *Virtue* to the *Spring*, or the *Spring* to the *Tree*: from which, and other *Inquiries* I have still been diverted by publick *Employments*.

The last which I shall mention, is of *Earth* which hath a petrifying quality, and this I was only inform'd of by *Mr. Castle*, a known person both for *Integrity* and *Estate*, in one of whose *Mannors*, near *Cambridge* there is an *Earth*, where as he told me, He had taken up several pieces of *Wood* which were turned into perfect stone, and this is confirmed, in *Cambden's Brit.* p. 401. of a *Ladder* turn'd to *stone*, which, he saith, was taken out of the *Earth* at *Asply Gowish* (I suppose in the same *Mannor*) which was kept in the *Cistertian Monastery*, near *Asply*, as a great *Rarity*, and I have both read and heard of the like *Earth* in other places: But it is an *Error* to attribute this to the *Earth*, whenas it is only a *lapidinous Water*, which is in the *Earth*, and infuseth it self into such porous *Bodys*, and so makes it become *stone*, and that which confirms me herein,

is,

is, That near this, there is a Quarry of *stone*, or Earth and water turn'd to *stone*, but it is of that nature, as Mr. *Castle* inform'd me, That if it be digg'd by the Rule of the Compass, and mark'd N. for *North*, and S. for *South*, &c. and laid in any structure as it was digg'd from the *Quarry*, it proves a very durable *stone*, but if laid otherwise, it moulters to sand; which is of late years not only observ'd, in digging and placing other Stones (though more consolidated) but also in removing Plants, derived from Water and Earth.

Now I observe in the whole matter, That this Water that thus petrefies it self or other substances, is adapted with a *lapidinous* Nature, not only to condensate it self but such other substances as may imbibe that quality: so that it is not properly called, *cold* (as is commonly said) that turns water into *Icicles*, but a volatile *lapidinous* water, that flies about, which as *cold* or *coldness* doth improve to *petrefaction*, so *Heat* or other *warmths* do hinder from condensation, and this petrefying *water* is of a *salt* and frigid nature, as we may see, that if *Snow* and *Salt* be put into a *silver, tin* or *pewter Pot*, and set on a *Board*, wherein fresh water is to be pour'd, and then move the *liquor* about in the *Pot* with a *Stick*, and in less than half an *hour* the water under the *Pot* will be congealed to an *Ice*, and so will glew or freeze the *Pot* and *Board* together, of which you may read more in *Berkley's Argenis*. So I shall refer the further Discourse of *Petrefying* to the word *Waters*.

PEWTER, T. *Speanter*, but the *Pewterer* or maker of it is called *Kanngiesser*, L. *Plumbus Cinerem* (*Holliock*) and *Argentanus* (*Minsh.*) but the *Italians* call it *Stagnaro*, from *Stannum, Tin*, for it is properly an Art derived from the *Stanniries* or *Tin Mines*; because the best *Pewter* is where all or the greatest part is *Tin*, yet they put with it sometimes *Silvery Lead*, but for want of that, a little *poor Lead*, or the *Ashes* or *Dross* of *Lead*, but when it is much *adulterated* with *Lead*, it is quickly *discerned* by the weightiness of it: but the

T.



T. calls a *Pewter Dish*, *Dish Zienen schuesshel*, which is a Dish made of *Tin*. l. 2. c. 20. f. 2.

PIBBLES, T. *Keisel-steine*, from *Kisel* a *Flint*, L. *Calculus à Calcando*, because it may be kick't up and down; and as they are little of themselves, so they are of little use about *Metalls*, otherwise then as they are beaten and mixt with *Metallick Flints*, l. 1. c. 4. f. 2.

PICTURES, T. *Bilden-Geinaild-a-maklen*, L. *Pictura* and *Imago*; the Makers of these are called *Picture-Drawers*, *Limners* and *Painters*, and these are of several sorts, but the chief *Composition* of their *Colours* are from *Metalls*; especially the *Effigies* on *Coyns*, which may be numbred amongst *Picturas solidas*, and this *admirable Art* of *Picturing* is borrowed from *Nature*; so that in this *Age* the *Art* is come so near to the *Original*, that nothing but want of *Life*, seems to *distinguish* them. l. 2. c. 48. f. 2. See *Sculptures*.

PINCERS, T. *Zangs*, from thence we have our word *Tangs* or *Tongs*, that is, to hold fast; L. *Forceps* and *Volfella*, these are of several *sorts* and *sizes*, according to the uses; for common *Fires* they are called *Tongs*, for small *Works*, *Plyers* and *Nippers*; but in *Metallick Work*, *Pincers* or *Tongs*: see *Utenfills*, and *Sculpt.* 11. &c.

PIPKIN, T. *ein Topfein*, from whence our word to *tope* or to *drink*, and the *Potters Clay*, of which these *Pots* are made, is called *Toepff*, L. *Ollula*, a little *Pot*, and these are used about *Metalls*. See *Utenfills*.

PITCH, T. *Pech* (according to *Minshaw*) but *Erckern*, *Bech*, L. *Pix*, and so most of other *Languages*, writ with *P*. and this *Pitch* is a *Black Gum*, which comes from a *Tree* of that *Name*, but are of the sort of *Pines* (whereof we have none in *England*) but have the *Gum* plentifully from other parts; the *white Pine* yieldeth a *white Gum*, the *Pitch* or *black Pine*, a *black Gum*; we have several uses of this *Word*; viz. the *pitch* of an *Hill*; to *pitch* a *Bar*; to *pitch* *Tents*; and a *pitch't Battle*: and all are but *Allusions* to the *glutinous* nature of this

[F f]

Gum,

*Gum*, used in *Luting* of *Metallick Vessels*: l. 4. c. 12. f. 2.

**PLANCHES**: see *Blanches*, both of them signifying *white pieces* of *Silvery Tin-Plates*, and sometimes for *Wedges* of *Gold* or *Silver*, or other *Metalls*, and from thence the word *Planks* are used, for *flat* or *plain pieces* of *sawn Wood*, thicker than *Boards*: l. 1. c. 1. f. 1. See *Blanches*.

**PLATES** of *Metal*, T. *Ein Blat ven Metal*, also *Blech*, L. *Lamina*, l. 4. c. 4. f. 4. or pieces of *Metal* made *flat* and *smooth*, and these are of *Iron*, *Tin*, *Brass*, *Copper*, and such as are of *Silver* or *Gold* (wrought in various shapes) as *Cups*, *Dishes*, &c. are still called **PLATES**.

**PLASTER**, T. *Gips* and *Tinchwerk*, L. *Gypsum* and *Empblastrum*, this is a composition of *Quicklime*, made of *common Lime-stones*, but the best is of *Alabaster*, and this is used without any mixture of *Sand*, and is an excellent *Fence* against *Water*; but *Pliny* tells of a natural *Plaster* in *Cyprus*; but we have none such, and therefore do use *Alabaster* or *Talk*, both of which he mentions (l. 36. c. 24.) wherewith in those days they made *Fret Works* and *Images*; but of later years they are grown to a great *Perfection*, by a *Past* of that *Plaster*, to *mould* and *fit* it to any part of *Man* or *Woman*, and so take the perfect *proportion* of that part, be it of *Face* or *Hand*, and when that is dried, they put a like *past* into the *Mould*, so as by *joyning* of the part so *moulded*, the whole *Body* of a *Man* or other *Creature* may be *represented*, in a *pure white shape*; which may be *coloured* as they please: These are graceful *Figures* (and may be seen at many *Stone-Cutters*, but very *subject* to *break*) yet much less than those of *Wax*, which *Art* is also come to great *Perfection*. See *Utenfils*.

**POLISH**. T. *Polieren* and *Polirs*. L. *Polire*. l. 1. c. 34. f. 6. and this is done by rubbing *Metal* with *Puttee* (made of *calcin'd Tin*, or with other *Stones* (as the *Hemathite*, &c. see *Blood-Stone*) or other *smooth* and *hard Metals*, as *Steel*, *Iron*, &c. to make it render its *natural* or *artificial colour* more *beautiful*; and it may have a just relation to *Policy*, by which *Art*, even

Go.

*Governments of Kingdoms, States or Cities* are made *smooth* and *pleasing* to the Judgments of Men. *see Hemathite.*

**POTTERS** - work, and Pots, T. *Toepffer*, *Zeng* or *Werck*, L. *Figulus*, and Operator *Figuli*, (l. i. l. 2. l. 4.) that is a maker of Pots; which the *Jews* well knew when they wrought in that ART under *Pharaoh*, but whether they were *metallick Pots*, as *Crucibles, Tests, &c.* it is not said: and he that is a good *Assayer* as *Erckern* was, will see them made himself, and not trust to the *Potter.* *see Clay, Pots, Cruises, Jugs and Utensils.*

**PRECIPITATION**, T. *Nider Schlag*, (l. i. c. 33. f. 3.) L. *Precipitatio*, or to *beat* or to *make that Nider*, or *Nethermost*, which was *uppermost*, and I do use the words often to *cast down*, for so L. *precipitatio* signifies: Now how *Metals* are thus *cast down* or *precipitated*, is seen in several parts of the four first Books: but the general way of *Metals* is first to *dissolve* them in *Aqua fort.* or *Aqua Regis*, or *Spirit of Nitre*, or *Vitriol*, and then they may be *precipitated* with *Sea water* and *Alcalious Lixiviums.*

**PROCESS**, (l. 2. c. 45.) is no other than the proceeding in the *Metallick Art*, as it is in the proceeding of the *Civil Law*, till Judgment, &c.

**PROOF**, proving, l. 1. l. 5. *Vid. Assaying*, of little difference, for *Proving* is but an *Assaying.*

**PULVERATION**, and *Pulverising* (l. 1. c. 8. f. 4) signifies the *beating* of any *Oar*, *Metals* or other things to *dust*, (sometimes called T. *Slaut*. L. *Pulvis*) or to *ashes*. (T. *Aschen*. L. *Cinis*,) or to *Powder*, (T. *Pulvir*, L. *Pulvis*;) and these three are made by *natural* or *artificial* Fires or Heats (for *contunding* or *beating* things to *dust*, *ashes* or *powder*, is but an *artificial motion* of *Heat* (for no motion is without *heat*;) and these *dusts*, *ashes* or *powders* are but the last Works of Nature upon all *Bodies*, for the next work is a *metaphysical* reducing the *Ashes* of all *Bodies* to a *Purity*; and as we see here the *dust* of *Metals* and other things by *Calcination*, *Incineration* or *pulveration*,

*veration*, what admirable products are from them; so we may thereby be convinc'd that the *Omnipotent Chimist* of all Creatures will shew his *Divine ART*, in improving the *Dust* and *Ashes* of our *Bodies* into a greater *Purity* than what we in this *World* (or *terrestrial Mine*) can enjoy: for here we are subject to all impure *Mixtures* till a *super-celestial* fire shall *purify us*, and who knows but that the *Spheers* of the seven *Planets* are the *Gradations* of those seven *Fires* which *David* speaks of, with which we must be seven times *refined*, before we can be admitted into *St. Paul's* third *Heaven* or the *Heaven of Heavens*: and I cannot here but call to mind the *Rapsody* of *Dr. Donne* (*Ser. vol. 2.*) speaking of the *Resurrection* of our *Dust*; saith thus, 'Where be all the *splinters* of your *Bones* which a *shot* hath *shivered* & *scattered* in the *Air*? (or, of those *Bones* which the *Metallick* fires have consumed to *ashes*?) where be all the *Atoms* of the *Flesh* which a *Corrosive* hath eaten? or a *Consumption* hath breathed, and exhal'd away from our *Arms* or other *Limbs*? in what *wrinkle*, in what *furrow*, in what *bowel* of the *Earth*, lye all the *grains* of the *ashes* of a *Body burnt* a *thousand years* since? in what *Corner*, in what *Ventricle* of the *Sea*, lies all the *felley* of a *Body drownd* in the *general Flood*? what *Coherence*, what *sympathy*, what *dependence* maintains any *relation*, any *correspondence* between the *Arm* that was lost in *Europ*, and that *Legg* which was lost in *Africa* or *Asia* (score of years between)? One *Humour* of our *Bodies* produceth *Worms*, and those *Worms* suck and *exhaust* all other *humours*, and then all *dyes*, and all *dryes* and *moulders* into *dust*, and that *dust* is blown into the *River*, and that *puddled water* tumbled into the *Sea*, and that *ebbs* and *flows* with infinite *Revolutions*, and still, yea still *God* doth know in what *Cabinet* every *seed pearl* lies; in what part of the *World* every *grain* and *particle* of every *mans dust* doth lye.

Now we are to believe, that this *scattered Dust* over all the *Elements* shall (in the twinkling of an eye) have a glorious *Resurrection*,

*surrection*, far more glorious than what is producible by *Metallick Art*, which serves here but as an Illustration of what may be expected hereafter; but to return to our *Chymical Dust*, *Ashes* and *Powder*, the *dust* of *Diamonds* is most remarkable, because nothing can *master*, *cut*, or *polish* a *Diamond*, but by its own *dust*; and it is a *delicate Art*, especially their *Mills*, by which with the *dust* of it they make so many curious *Angles*, as that they are all reflectionary glitterings, and sparkling *Lights* to each other.

Then for *Ashes*, the several *Lixiviums* or *Lees* which are made of the several sorts of them, they are of great use in *Chimistry*, especially those that are made for *Salt-petre*, without which scarce any *Metallick Operation* can have good effects.

And for *Powder*, the most eminent is, that which is made for *Guns*, viz. (of *Salt-petre*, *Charcoal* and *Brimstone*, and some other *ingredients* to heighten their *tempers*,) and when it is perfected for the use, it doth as it were revenge its own *Contusions*, by shattering the pieces of others almost into *Atoms*, and therefore called *T. Buechsen-pulver*, *L. Pulvis tormentarius*, as if it had been invented by the Friar, to torment others before their time.

Now seeing I am writing of *Gun-powder*, I have long since considered of the vast quantity that is spent in *salutes*, &c. and it was my chance to meet with an *Ingredient* of a cheap rate, with which, supposing a pound of *powder* to be used, I took a 4th. part of it, and three parts of my *Ingredient*, (which was not of the charge of a 4th. part of *Powder*,) and with that mixture did make a Report rather greater than less than the whole pound of *powder* would have done; but this compounded *powder* is more for *noise* than *execution*, which is the chief use of *Salutes*, or for *Triumphs*, whereby half 3 parts of 4, in the charge of common *Gun-powder* may be saved.

And seeing I have told you of a *powder* of *Salutation*, give me leave to tell you, That I have found out a *powder* of *preservation*,

vation, such as without *Salt* shall keep Meat in its Blood and Gravy, *untainted* or *unputrified* for more than a year: of which some little experiment I have made, but not sufficient to satisfy my self.

There is yet another *Powder* which I am to speak of, *viz.* a Powder of *Dulcification*, which is a peculiar *Art*, but for that I shall conclude with *Herbet*, that *Divine Poet*, as an admonition for the good use it,

*When Hair smells sweet through Pride or Lust,  
The Powder hath forgot the Dust.*

**PURIFICATION**, *purifying*, T. *Rein, Reinigen, Sauberung*, L. *Mundatio, Purgatio, Purificare, Clarificare, Defecare*, to separate *Metals* from dross, either by washing, by clarifying, filtering, digestion, or distilling; and this is done by water only, or by fire only, and sometimes by both jointly: See *Cleansing, Purging, Clarifying*.

**PUTRIFACTION**, T. *Verrottung & Verfaltung*, L. *Putrifactio*. A. *Rottenness, Corruption, Putrefaction*, &c. as *Bees* from a *Lions Carcass* (Judg. 14. 8.) *Snakes* from the *Corruption* of *Horse-hair*, *Magots* and *Flies* from *corrupt Flesh*, *Eels* from *corrupted Dew*: and in all *Histories* of *Nilus* it is said, That the *Mud* thereof breeds (besides other larger Creatures) an infinite number of *Mice*, in which Experiment, we need go no further than the *Island* of *Foulness*, in *Dengy* hundred, in *Essex*; where, as my Author *Mr. Bernard* (a very credible Gentleman) affirm'd to me, and it is confirm'd by *Chiswell* in his *Britania Baconica*, that about the end of every year, in his ground there, a prodigious number of *Mice*, were bred from the *Soil* of his *Grounds*, so as he had often seen some of them not fully shap'd, and these *Mice* about *August*, did devour all the roots of the *grass*, whereby the *grass* being withered, the whole ground seem'd like a *bed* of *chaff*, wherein the *Mice* delighted themselves; but whilst they were in their *sports*,  
about

about the end of every *September* there came a sort of little *Owls* (in great numbers, but much less than those which are bred in *England*;) and so being fill'd and fatned they flew away again, and what with the chaff and carrion of the *Mice*, and dung of the *Owls*, the next *Spring* the grounds produced again plenty of *Grass*, which fatned him yearly many good *Oxen*: Now this *putrefaction* is not only seen by producing such *Insects*, but in *Metals*, for the *Rusts* of them are but *rots* or *putrefactions*, as when *Ceruse* is produced of *Lead* made rotten with *Urine* or *Vinegar*; and *Verdigrise* produced from *Copper* made rotten by fumes of *Wine*, and many such like *putrefactions*.  
See *Pulveration*, &c.



**QUARRY**, T. *Steinegruben* (which word *Grub* is used in *English* to search for *Stone*, &c.) L. *Lapidicina*, *Latonia*, *Latumia*, *Litbomia*, and *Fodina*; and for a *Quarry* of *Mill-stones*, *Cotaria*.

It is not agreed from whence this word is derived, but the *French* comes nearest to the matter, viz. *Querir*, from the *Latine* *Querere* to seek (or *pro qua re querit*; and so an *Hawk* is said to have her *Quarry*, when she hath got what she flew at; however it is called also *fodina*, which is the title to a *Mine*, and indeed the *Mines* for *Metals*, *Minerals* and *Stones*, are so near of kin that they may all be called properly *Fodinae*, see *Mines*, *Minerals*, *Stones*, *Waters*.

**QUENCH** (or to *Quench*) T. *Ermorden*, that is, to put to *Death*, also *Andeschen*, L. *extinguere*, which (in *Metals*)  
is

is, when the heat of them are taken away by *cold water*, so *quenching thirst* is the allaying of *heat* in the *body* by some *cooling liquids*: and it may also come from the *Quince Apple*, which hath the quality to allay *flames*, *thirstiness*, &c. coming from hot causes.

**QUICKSILVER**, T. *Quecksilver*, L. *Argentum vivum*, *Argentum liquidum*, & *fusile*, & *Hidrargirum*, or *Argenteum aqueum*, and this by *Chimists* is devoted to the Planet *Mercury*, and so by them also called *Mercury*, for its *Agility*; and therefore the *Heathens* (who worship'd it as a *God*, yet) put an humane shape on it, with *Wings* to his *Feet*.

But our *Metallick Mercury* or *Quick silver* is of two *Sorts*, viz. *Adulterated*, and *Natural*; as for the *Adulterated*, it is easily discovered, by putting some of it into a *Spoon*, and so over fire let it *evaporate*, and if it leaves a *black*, or *darkishness*, 'tis false, but, if *white* or *yellow*, 'tis good. As for the *Natural* (as I said in the word *Metal*) we have very little or none in our *Mines*, so that we do fetch it from our *Neighbours* out of *Hungary*, *Spain* or *America*, &c.

Many have written largely of the *Nature* of it, and therefore I shall only tell you, It is seldom found in the *Earth* with any of the beforenamed *Metals*, but delights it self in the *Cinnabar*, *Vermilion*, or *Minium* Stone (of a *Metallick* nature, (much us'd by *Painters* and *Dyers*) and there naturally is enclosed; and *Mr. Nicolls* (in his description of *America*) tells us, That in the *Vermilion Mines* at *Palcas*, it yields to the *King of Spain* every year 8 or 9000 *Quintals* (which is so many 125 *l.* weight of *Quick-silver*) and that of later years they refine more *Metals* by *Quick-silver* than by *Fire*, in which operation it hath this peculiar vertue, that it separates and consumes all of them but *Gold* and *Silver*, and though it will not ly in one *Bed* with them in the *Earth*, yet when they are made *Play-fellows*, or *fellow-Labourers* (for the use of man,) it doth most naturally sympathize with *Gold*, and divides and separates it from all other *Metals*, with which it is at any time intermixt: circling it about  
with-



without any other intermixture but it self; but it doth not so intimately and perfectly *unite* it self with *Silver*, for it doth not pierce it, but consumes the courser Metals from it, if there be any mixture; and though it be the heaviest of all Metals, yet if any Fire offer to meddle with it, it evaporates it self into the lightest substance. *smoak*, to some colder Region, (as its refuge or shelter,) where it again embodies it self, and becomes as perfect as at first, by assuming again its *natural colour, white*; and 'tis observable, That though it lies in a Bed of pure *Vermilion*, (which gives a glorious *red colour* to all things where-ever 'tis used;) and though it is used, and in a manner *incorporated* with *Metals* and other things of various *colours* and *natures*, yet this noble *active creature* still retains its *whiteness, purity* and *efficacy*.

For though by the strength of *Art* (as *Paracelsus* tells us,) it is sometimes forc't to assume a *yellow colour*, (to shew its affection to *Gold*) and sometimes to a *pure red* (to shew its native kindness to *Cinnabar*, yet these are rather *assum'd* and *assimulated colours* (in respect to other *ingredients* and *compositions* with it,) than any real change of its own *whiteness*, and so for its *Medicinal* uses, it is sometimes called *Mercurius dulcis*, *Mercurius vitæ*, *Mercurius sublimatus*, and *Mercurius præcipitatus*, yet in all these dispositions of it, it still reverts to it self, (especially by the assistance of *Fire*, to make it *Volatile*) that it may be the better *fixt* in its original *purity*.

Now these observations cannot but raise my Thoughts, to make them applicable to the great *Mystery of Resurrection*; wherein I consider, That as the *Gallenists* are, or may be confirmed in the verity of it, by *St. Paul's* Argument to the *Corinthians*, 1 Cor. 15. 35, &c. So the *Chimists* may be also confirmed in the same by their *Chimical practice*; for they see that *Mercury* doth by *heat* so evaporate, that nothing of it is discernible to the eye; yet that *evaporation* being stopt in its *career*, by the top of the *Limbeck*, it there fixeth again in its *form, colour*, and indeed in all its *qualities, properties*, and *perfections*.

[H h]

Now

Now it is an undoubted Principle, both with the *Gallenists* (who follow *St. Paul*,) and the *Chimists* (followers of *Moses*,) That all *Terrestrial Bodies* consist of *Salt, Sulphur* and *Mercury*, (which last is the chief) so as our *humane bodies* being of a more *Mercurial* temper than other *bodies*, may experimentally, and therefore *rationally* believe, That all the *Atomes* of our bodies being incited to it, by an *internal heat*, do like *Mercury* ascend to some other *limiting Sphere* or *Orb*, and there stays, till *GOD* (the *Worlds* great *Chimist*) thinks fit to dispose of them at the *general Resurrection*, or *particular* (as he thinks fit.)

Now, where this *Sphere* or *Orb* is, (which some call *Heaven* and *Paradice*, others *Limbus Patrum*, and *Limbus Infantium*; and others have another place, called *Hell*, and *Limbus inferiorum*, (as it were *Antipodial* to the other :) I shall venture to give my guess, and possibly with as little satisfaction to the *World*, as others have done in theirs: and that which guides me to mine, is this consideration, That the name for *Quick-silver* is *Mercury*, and that that Name *Mercury* is also fixt to the *Planet* of that Name (next above the *Moon*, whereby I apprehend that the *Chaldeans* and *Egyptians* (who are said to be the first *Authors* of the *Astrological Characters* of the 7 *Planets*) did make both the *Planet Mercury*, and the *Metal Mercury* to bear one and the same figure, thus [☿] well knowing more of the *sympathies* and *concurring operations* of the *Celestial* and *Terrestrial Mercuries* than is yet communicated to us; but the *Hebrews* (before them) made seven of their *Letters* to signify the seven *Planets* and seven *Metals*, and thereby the figure of *Mercury* (before it was altered by the *Egyptians*, was in this form [⚔] and sometimes thus [⚔]) And the *Jewish Rabbins* did hold, that those two *Letters* did contain great *Mysteries*, (not yet also unfolded to us,) and therefore I hope it is no offence to conceive, That the *Sphere* of *Mercury* is the *Paradice* or *Receptacle* of all the *Mercurial spirituous Forms*, of which our bodies do consist, and when they are *evaporated*  
from

from hence they (by an invisible ascention) are received and remain in that *Paradice* or repository, so that the *Globe* of earth being 21600 *German Miles* in circumference (accounting 6400 foot to a *German mile*) and the *Diameter* 7200 *Miles*, and the *Planet Mercury* in the lower part of its *Sphere* (next the *Moon*, being 10255773 *German Miles*, and the upper part of that *Sphere* next to *Venus*, being 22855511 *German miles*, then the space of the *Sphere* of *Mercury* (considered *Diame-*trically) between the lower part of the *Sphere* of *Venus*, and the upper part of the *sphere* of *Luna* is 11599738 *German miles*, which great space may easily contain all the *Mercurial forms* which can possibly arise from the content in the small circumference of the *Terrestrial Globe*, and allow also sufficient room for the body of that *Planet*, (being as 'tis said, but 442 miles in *Diameter*,) so that it hath a space of 62999698 *German miles* above, and as much under its own *Globe*, in which it may move and actuate.

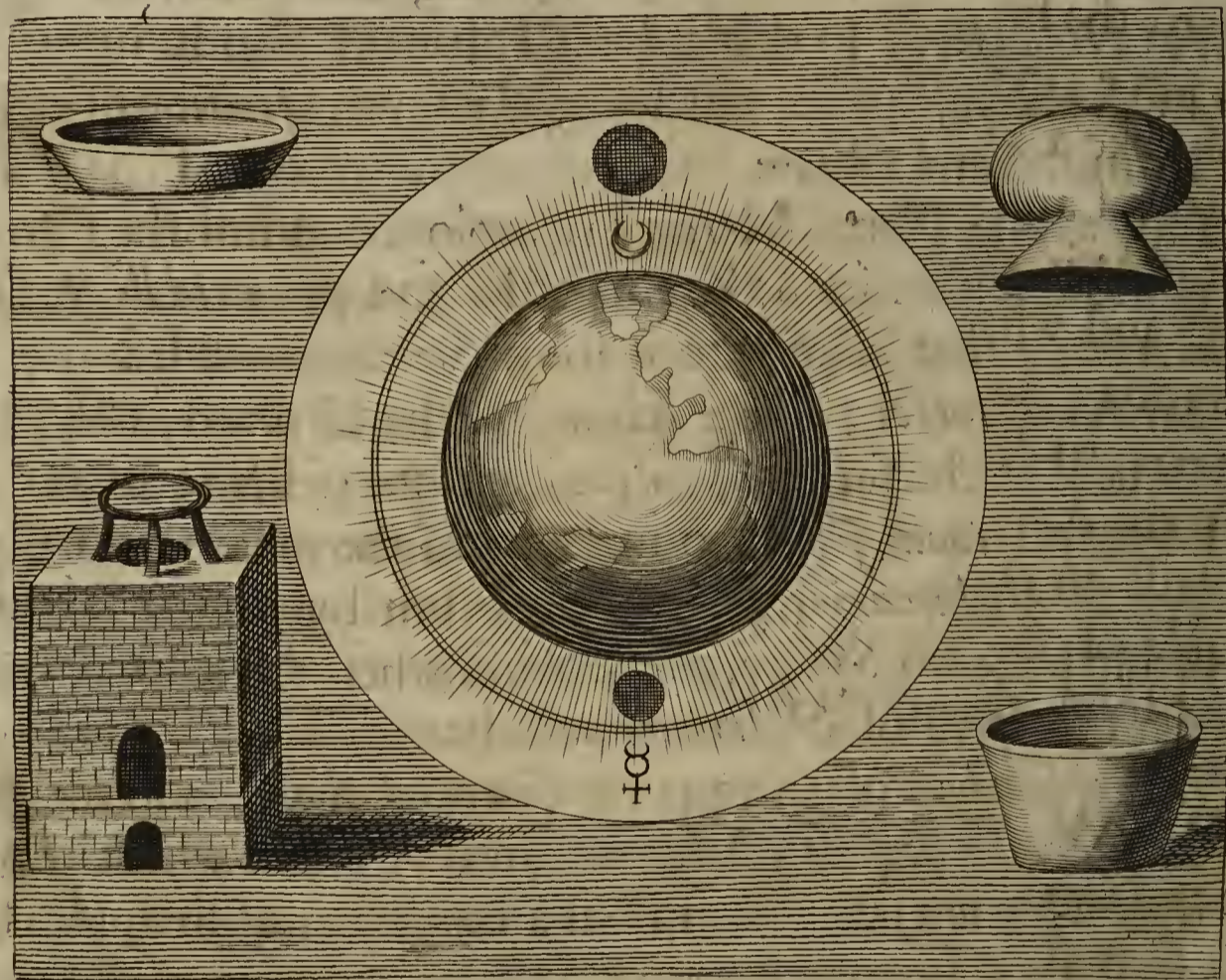
And, as the *Planet Mercury* is imployed in its own *Circular Motion*, within its *Sphere* to order and put every *Mercurial Matter* that ascends to it from the *terrestrial Globe* into peculiar *Repositories*; so the *Moon* may be admitted also in her *Sphere* to give the first *rarification*, and *purification*, to the ascending *Spirituons forms* to make them the more fit in their *Passages to Mercuries Reception* of them, and retain the refuse within her own *Sphere*, which consists of a space also (*viz.* between the *Spere* of *Mercury*, and the outward *Circle* of the *Terrestrial Globe*) of 10234173 *German miles*, for the *Planets* themselves, *viz.* of *Mercury* and the *Moon* (as I have shewn of *Mercury*) do take up but a little *Room* to *roul* about in each of their proper *spaces* or *Spheres*, and though *Kepler*, and others of late do not agree in their *Computation* about the *dimentions* of these two (and the other *Spheres*) yet these which I have set down (being generally so computed) may well serve as an instance, that so great *spaces* were made for some such uses as I have exprest: so that by the active *Operations* of the  

Bodies

Bodies of these two *Planets* (*Luna* being but as a *Servant* or *vehicular* to *Mercury*) the *Mercurius Dulcis* and *Mercurius Vita* of all *humane Bodies* may be sublimated into that *celestial Paradise*, and the *Caput mortuum* or *Mercurius præcipitatus* thrown down into a *Limbus*, either in the space of the *Moon* (at present) or to the *Abyss* of the space of the *Earth*, when it shall (by the last *conflagration*) be evaporated or annihilated into a kind of *Vacuity* for that purpose.

But having spoken something more of my *Conjecture* in my *Volatiles* on *Adam* and *Eve* (under the *Discourse* of *Resurrection*) I must refer you to it; and shall only add this following *Sculpture* for *Demonstration*.

Sculpture XLIII.



R A



R A

**R**ATTER, l. 2. c. 2. T. Raeder, I find no Latine word of kin to the sense of what *Erckern* intends by it, viz. a riddle, screen, or sieve, that is an Instrument to separate the clean from the unclean Oars, before they come to the fire, and so may be called *magnum Cribrum*, or a great sieve; yet it may come from *Rotatilis*, that is, moving swiftly like a Wheel, or *Rota*, shewing the proportion of Metals, or of any thing else; Riddle, which in the T. is *Rat-zall*; that is, that the Question being what part of the Oar is clean, and what unclean, this instrument doth unriddle it by separation: and for the word screen, it is doubtless from *secernere*, to divide, and sieve from *segregare* or *severe*, to know truly the quality of the thing by separation; There are other Words to the same effect, as *seirce*, *boulter*, not worth the trouble of examining their Original, but by *Ratter* is to be understood the great sieve, and the other the lesser sieves. See Sieves.

RAW (l. 2. c. 3. f. 4.) T. *Rohe* and *Rode*, also *ungesotten* and *ungekockt*. L. *Crudus* and *Atrax*, A. *Ram*, which is some old British word, signifying not concocted, and so applied to Metals before they are brought to the fire to be boyl'd or roasted. See Roasted.

REEDS, l. 5. c. 4. f. 3. T. *Robz*. L. *Canna* and *Arundo*. See Utenfils.

RECIPIENT or Receiver, l. 2. c. 20. f. 6. T. *Emphaben*, L. *Recipere*, signifying Glasses, Pots, or Vessels which are made

to run or hold *Metals* made *liquid*, or what is drawn from them by fire, or otherwise.

**REFINING** signifies no more than when *Metals* are melted and *fined*; yet to make them better, they do refine them, that is, melt them *again* and *again*, till they be clearly *cleansed*, *purified* and *purged* from the *unclean metal* or *matter*, cleaving to the more *pure*.

**REGISTER**, T. L. A. *Register*, and it signifies with us a *Memorial* or *Record*, so the Word is applied to the *Records* in several *Courts* of the *Common* and *Civil Law*; and these are very ancient (as appears by *Sir Thomas Smith*, de republica) but in the *Metallick Art* it is used for *Pluggs* or *Stopples* to be put in or taken out of little *holes* made in *Furnaces* or *Ovens* (called *wind-holes* and *air-holes*,) whereby the *fire* may be better governed, by giving heats or cools to the *Metals*, according to the *discretion* of the *Chimist*.

**REGULUS**, l. 2. c. 35. &c. L. A. *Regulus* (which signifies a *small King*,) but *Erckern* in all places (where he hath occasion to mention it,) doth make use only of the word *Koenig* (or *King*, and not *Regulus*,) from *konnon*, signifying *knowledg*, *power* and *ability* to *Govern*; and the *Old Saxons* called him *konning* and *cunning*, which we translate *subtile*, (yet not as the vulgar interpret it *crafty*,) but one that is *Learned*, and *judicially polite* in his *Government*; now though *Metals*, (by some) are put among *inanimates*; yet others believe that they have a *vegetable Soul*, which is improved to an higher *Soul* by *Obedience* to its *king*; for it is agreed by *Chimists*, That this *king* doth give such a *soul* and *temper* to *Metals*, that thereby they prove beneficial to the *World*, and gain an *esteem* to themselves, both for their *Origination* to *Wealth* and to *medicines*, *colours*, *sounds*, &c. and all these they obtain by *obedience* to their *king*: and this puts me in mind of our *Alphabetical Letters* (which I think is included in the *Talismanical science*) whereof *God* himself saith, That he is the *Alpha* and *Supream King* of them, (as of all *mankind*, and other creatures:) so that


if we consider them in their *virtual effects*, then such men as are Learned in them, and do pay their *obedience* by *Devout Vows* and *Promises* to him, may be called *Vowels*; such as act and do his Will at *Land*, may be called *Consonants*, such as admire him for the *Wonders* they see at *Sea*, may be called *Liquids*; and those that sit still in their *passive Obedience* (not grumbling or mutining) may be called *Mutes*, and these are the *Grammatical* methods of *Letters* and mens *Obedience*; now from the *consonants, liquids* and *mutes*, with the conjunction of *Vowels* (like *Magistrates*) they are formed into *Words*; and therein also God the Son will be owned as the chief of *Words*; and when they come to a *Talismanical Operation*, they may be ascrib'd to the *Holy Ghost*: In short, though the *Letters* seem to have no visible vertue in them, yet this is evident, that by submitting themselves (or men like *God-fathers* doing it for them) to that *order* which the great *Alpha* hath thought fit, *mysteriously* to direct, they are formed into *syllabical words, sentences* and *discourses*, whereby *God, Angels, and Men* seem to have a mutual *correspondency*; but when there is no obedience to that *order*, there is nothing but *misconstructions, non-sense* and *irregularities*, pernicious to themselves and others; And it is not only thus in *Metals* and *Letters*, which (though accounted *inanimate*, as I said, yet are or will be forced to be *obedient* and *regulated* by a *King*: but in *sensitives*, the *Bees* have a *King*, and by their *obedience* to him, they enjoy the fruits of their *Labours*, and take pleasure in returning each to its own *Cell, or House*, which is guarded with *Waxen walls*, and filled with *Honey* sufficient for its own food, and an overplus to supply others, and this proceeds from the happy product of *Obedience*, whilst the *stubborn, refractory, or lazy Droans* are thrown out of their *Hives, Houses, and Homes*, which they might otherwise have enjoyed, if they had not been *disobedient*; I might instance more, but it is enough for me that I have shewn the advantages which *Metals* have by their *Obedience* to their *King* or *Regulus*.

RETORTS, *See* Utenfils.

ROASTING of Oars or Metals, l. 1. c. 10. T. *Groesten Roesten*, A. *Rost a Rore usta*, or the burning away the Dew or moisture of Metals.

RUBRIFIED, l. 2. c. 44. s. 2. T. *Fast rotten*, L. *Rubrificatus*, and I suppose the Red Sea is called *Mare Rubrum*, from some red Mineral under it.

RUSSET cloath, T. *Unbercite*, L. *Pannus fusci coloris*, A. *Russet cloath*, which is Brown or between a white and black colour; it may come from *Rusticus*, because Country-men seldom use dyed or undrest cloath, but only the natural colour of Sheeps Wooll, when it is neither black nor white, but as a mix'd colour; however this is recommended by *Erckern* for retaining of the Gritts or Sands of Gold, so as they may not suddenly be wash't away with other Rubbish.

S A            S A

SALT, l. 1. l. 2. l. 3. l. 4. and l. 5. T. *Saltz*, L. *Sal*, which may come from *salus*, Health, according to the Verse, *Non sapit esca probe, quæ datur absque sale*: for indeed it gives not only to Humane bodies, but to Metals a vivacity and sanity; *Minshaw* deduceth it from *salire*, because it sparkles and leaps in the fire: Now of Salts there are several sorts, (as may be read in *Pliny*, lib. 31. cap. 7. to the 11. and in other places and Authors) but most *Chimists* do agree, that there are seven several sorts, which are influenc't from the seven Planets, to attend the seven Metals; and these *Erckern* accordingly makes use of, viz. *Sal alkali* (or sandiver, or salt of Glass,) *Sal Armoniaci*,

*Sal*



*Sal Nitri, sal Vitrioli, sal Petre,* (and common *Salt*;) *Sal Tartar* (or *Argol*, of which I have spoken,) and also *Sal Gem*, (which is the seventh *Metallick Salt*;) and is produced from a *Rocky Crystalline stone*, and of these he speaks, and of no more, it being a subject of great extent, for I conceive there may be as many sorts of *Salts*, extracted, as there are *Terrestrial Creatures*, for all things do consist of *Salt, sulphur* and *Mercury* (as I have said) but that which I aimed at, was to give an account of our *natural salts*, from *springs* in *Cheshire* and *Worcestershire*, and from the *Lands* on the *South sides* of *Devonshire* and *Cornwal*, which are full of *Salts*; for with those *Sands*, so mixt, they *manure* their *Lands* to a great profit, and of which most other *Coasts* of *England* are wanting, and have only the *Sea-water* to make their *Common-Salt*, but I cannot enlarge my observations upon any more words, because the *Printer* calls for what I did write of a *Metallick Dictionary*, after I first proposed the *Printing* of *Erckern*, but intending within the compass of a year to publish *Georgius Agricola, de re Metallica* (being fully translated,) in *English*, and also to add a *Dictionary* to it, I shall reserve my remaining *Essays* (if what I have done hitherto, be approved) till then, and so I proceed in the *Dictionary*.

**SANDS**, l. 1. 6, 29, &c. **T.** and **A. sand**, and so the *Belgick*, but the *Italian*, the *Spanish* and *Latine* call it *Arena*, and the *French*, *Sables*, (which in *Heraldry* signifies *black*;) also it is the name of the *Furr* of a little *Beast*, called *sabellus*, and *mustulus, sarmaticus*, of a *sandy colour*. However *sand* is of various uses in *Metallicks* (as *sand-Ovens*, &c.) and consist of great varieties in *England*, which may admit of curious speculations. See *Earth, Gold, Mortar, Ovens, Petrification, Stones, Water*.

**SANDIVER**, l. 2. c. 5. s. 1. &c. is the same with *sal Alkali*, which *Pliny*, (l. 31. c. 7.) calls the *Tragasean salt*, and is the same with *sal Vitri*, or *salt of Glass*.

**SCALES**, are of a *Ballance* for weighing *Metals*, whereof you will find two sorts in *Erckern*, viz. *Proof scales*, l. 1. c. 34.

*s. 12.* and *inset scales*, *l. 1. c. 35. s. 2.* T. *Tung*, *schuell*, L. *Lanx*, also for *scales* which come from *Metals*, T. *schuepen*, being the same word which they use for the *scales of Fish*, signifying the *scurf* or *flaky* matter taken off from *Metals*, sometimes by *filig*, but chiefly by *fires*, *l. 2. c. 26. s. 2.* and *c. 36. s. 2.* See *Flaky and Flaky, Shivery, &c.*

SKIM or *skum*, *l. 2. c. 47. s. 2.* and *l. 5.* T. *schaum*, L. *spuma*, A. *froth*; but in *Metals* it is, when they first rise into a *drossy* matter, yet not so thick as *dross* till it is more condensed; but in other things it hath only the name of *Froth*, fit to be *skimm'd* or *skumm'd* off: See *Dross*, *Scorias*, *Yeast*.

SCORIAS, *l. 2. c. 35. s. 2.*, &c. T. *Trufer*, L. *scoria*, A. *drossy*. See *Dross*, *Skim*.

SEARCE, to *searce*, T. *salter*, L. *cribrare*, A. to *searce*, *serce* or *sarce* (*Skinner*,) which is to express the operation of a *seeve*. See *Seeve*.

SEEVE, T. *sib* and *sieb*, L. *cribrum*, A. *seive*, *seeve*, or *sive* (*Skinner*,) See *Ratter*.

SEPARATION, T. *Absouderen* (from *souderin*, to *so-*  
*der* or to *joyn*, and so *absouderen*, to *disjoyn*,) L. *separatio*, A. *separation*, and in the *infinitive* of *separo*, it is *separare*, or *segregare*, from whence the T. call a *separating Oven*, a *sagar Of-*  
*fen*, *l. 3. c. 15.* and so *sagar worke*, which is a *distinguishing* or *dividing mixt Metals* from each other, or other matters, ad-  
herent to the *Metals*. See *Quicksilver*.

SHIVERY, or to *shiver*, *l. 1. c. 34. s. 3.* T. *schivern* or *schiffern*, L. *disrumpere*, when *Metal* is loose, and easy to break into pieces; and sometimes *light Oar* is called *shiffer Oar*.

SILVER, T. *silber*, from the *Greek silbo*, (*Minsbaw*,) A. *silver*; now as to the *inlarging the Etimology* of this word, used by the T. and *Old Saxons*, and so continued here; I must refer it to another time: only I observe that the *French* and *Italian* do comply to the *Latine* word *Argentum*; but the *Spaniard* calls it *Plata*, probably from the chief *City* and *Province* of that name, in *America*; or from the great *River Plata*,  
which

which runs 2000 miles through the *American Mines*, before it unloads its Wealth to the *Spanish Navy* (termed his *Plate-Fleet*) which supplies himself and his *Neighbours* with its *Treasures* of *Silver*, *Gold*, &c. I might also add many things about the *fining* and *refining* of their *Silver*, before it comes unto that *Fleet*, but I refer that to *Erckern's* four first Books; and *N. N.'s* Survey of *America*: for I know not the *Author*; but I find it ingeniously writ. See *Metals*, *Mines*, &c.

SLACK, *slackstones*, and *Slicks*, T. *Schlack* and *Schlick*; (often mentioned by *Erckern*, l. 1; 2, 3 and 4.) L. *Laxus*, and all signifying the loose parts of *Oars*, or the *Oars* made into *Metals*, yet still do remain *slack* and *shivery* in some part, and sometimes is taken for *Dross*, and that *Dross calcin'd* goes for *Calx*, or *slack'd Metal*: See *Calx*, *Calcine*, *Lime*, *Dross*, *Flakes*.

SMELTING, l. 4. c. 14. l. 4. c. 1. &c. See *Affaying*.

SOPE, T. *seiffe*. L. *Sapo* and *Smegma*; *Pliny*, l. 28. c. 12. gives an account of its *Vertues*, and how it is made, but I question whether that be the *Venetian sope*, mentioned by *Erckern*, l. 2. c. 47. f. 2, &c. or the *Tin-sope*, l. 4. c. 13. or the *Gold sope*, l. 5. c. 10. f. 8. of which I shall discourse at another time.

SPAN. T. *Spann*. L. *Spithma*. See *Measures*.

SPAR. l. 3. c. 27. f. 6. T. *Sparstein*, a white stony Matter; that usually embraceth the *Oars* of *Lead* and *Silver*, called, L. *Fluor*; the word is also applyed to long pieces of *Timber* which serve for the *Roofs* of *Houses*, call'd *sparrs*.

SPARKLE, vulgarly *spartling Oars*, T. *Fuencklen-erkz*, L. *scintillare*.

SPELTER, T. is the name of a course *Oar* containing little *silver*, l. 1. c. 2. f. 11, and 15. of which there is a better sort of *Oar* called *Bismuth* or *Wismet*, viz. when it runs bright and well in the *fire*. See *Wismet*.

SPIZE, or T. *Speizy-Erks*, or gross thick *Oars*, reckon'd among *course* or *unclean Oars*, and in *Erckern* (l. 1. c. 2. sect. 11.) fully described cap. 16. for the melting of which,

which, particular *Ovens* are made, See Ovens.

SPUNGE, *l. 2. c. 4. f. 1.* T. *Schwam*, L. *Spongia*, but how it is *produced* from, and used for *metals*, deserves a longer *Discourse*.

STEEL, *l. 4. c. 20. and 27.* T. *Stabel*, & *Stabel steine*, L. *Chalybs*, now this and all other sorts of *Iron*, are by *Pliny* (*l. 34. c. 14.*) comprehended under the word *structura*, and he farther saith, That the goodnes of *Steel* ariseth from the goodnes of the *Iron-Mine*, from whence it comes, with the assistance of *Waters*, and various *Quenchings* of it in *Waters* or *Oyls*, to which he adds, That 'tis wonderful that *Man's Blood* should have such *Virtue* in it as to be reveng'd on the *Iron-blade* that shed it, for being once *imbrewed* therein, it is given ever after to *rust*, and *canker*. See Iron.

STONE. T. *Steine*. L. *Lapis* and *Petra*, which hath *hanc Petram* in the Accusative Case, for making such work in the World, by its *affinity* to *hunc Petrum*: But not meddling with those *Disputes*, I might very well have enlarged my self upon this *Subject* of *Stones*, especially of those which *English Quarries* do produce, but I must also defer it.

SUBLIMATION, *l. 1. c. 28.* L. *Sublimatio*, which is a *separation* of *thin* and *fine Bodies* from their *gross* and *impure parts* by means of a *gradual Heat*, whereby there is a *white powder* called *Sublimate* made of *Calcantum*, *Quick-silver*, *Vitriol* and *Sal Armoniack*, which is used as a strong *Corrosive* upon *Metals*, &c. See Calcination & Quicksilver,

SUDS, See Lees, Lixivium.

SULLAIN, *Stubborn*, that is, *Oars* or *Metals* that are not *easily melted* by *fire*, as the soft *flowing Metals* or *Oars* are.

SULPHUR, T. *Schwefel*, L. *Sulphur*, and *lapis ardens*; of which there are various *sorts*, both *natural* and *artificial*, and many delightful *Observations* may be made on them: See Brimstone & Bitumen.

SUN, T. *Sonnen*, L. *Sol*, from which *Celestial Heat* and also

also from the *Terrestrial Fires*, many excellent things are produced in *Metals*; viz. in making *Aurum Potabile*, as also a most *sovereign Water* from the *rayes* of the *Sun*, by reflection on *Gold*, which I may hereafter communicate.

T A



T I

**T**ALCK, l. 1. c. 4. f. 2. T. A. *Talck*, L. *Talcum*, (by *Pliny*, l. 36. c. 22. called *Lapis specularis*, of which he gives a large Account. It is a foreign stone (for I do not hear of it in *English Mines*) of a glassy transparent Nature; resisting both heat and cold; the red is mentioned by *Erckern*, but the white more common.

TALLOW, l. 1. c. 17. f. 3. T. *Unschlet*, L. *Sevum* or *sebum*, A. *Suet* or *Tallow*, much used about *Metals*.

TARTAR, See *Argol*, *Dregs*, *Feces*.

TEST, T. *Schirbin*, L. *Proludium* (*Holiock*) but I had rather take it to be an abbreviation of *Testis*, as a *Witness* of the goodness of *Metals*, by trying and proving them in little vessels, prepared by *Assayers* for that purpose: See *Crucibles* and *Utenfils*.

THORNELS, T. *Deerleins*, fully explained by *Erckern* what they are, L. 3. c. 22. f. 3. In short, it is a term of *Art*, for that which remains of the roasted *Oar*, unmelted: See *Keinstocks*.

TILE, l. 2. c. 41. f. 1. See *Brick*, *Earth*, &c.

TIMODE, l. 2. c. 2. f. 8. T. a name for *Cloth* made of *Flax*, or *Hemp* or *Wooll*; and so in A. called *Linsy-woolsey*; which is used sometimes for *strainers* of *Metals*.

TIN; l. 3. c. 12. f. 6. T. *Zin*. L. *Stannum*, from whence we

[L I]

have

have the word *stanaries*; by which *Court* the *Tin-Mines* in *Cornwall* are governed: now this *English Tin* is esteemed to be the best in all other parts of the *World*; the *Spaniards* and *Italians* calls it *stagno de cornoij valla*: the *French* de *Cor-no Vall en Anglitterre*. see *Zwitter*.

**TIN**-plates, are properly *Iron plates* covered with *Leaves* of *Tin*, and because of the outward *Colour*, call'd *Tin-Plates*.

**TIN**-sope, *T. Zinseife*. see *Sope*.

**TONGS**,

**TOUCH**-needles } *Utenfils.*

**TOUCH**-stones } *See } Needles.*

**TOUCH**-stones } *Stones.*

**TOWER**, *Traves, Trevet*. see *Utenfils*.

**TREMBLE**, *l. 2. c. 48. T. Beben, and Zuttem, L. Tremere*: see *Boyling, Seething, Quivering, &c.* All expressing a different motion in *Metals*, whilst *Melting*.

**TROY**-weight, see *Measures and Weights*.

**TUB**, *l. 1. c. 11. f. 5. T. Fas, L. Vas, A. Vessel or Tub*: and are of various *Forms* used about *Metals*. see *Utenfils*.

**TUNNEL**, *l. 2. c. 16. f. 5. &c. T. Ein Tunnen, L. Tinnella. A.* do account it the same with *Tunnel* or *Funnel*, and yet the *T. L.* and *A.* have different words, viz. *T. Tas, Trebter, and L. Vas* and *Infundibulum, A. Tunnel* and *Funnel*. see *Utenfils*.

**TURF**, *l. 4. c. 9. f. 1. T. Hin Graszbuch, L. Cæsses, A. Sods, Turf, Peat*, which will admit further *Discourses*, viz. which of the three is best for *melting Metals*, when other *Fuel* is scarce: see *Utenfils*.

**TUTTEE**. *l. 2. c. 39. f. 2. T. Tutian, L. Tutium, Pomphilix* and *spodium* (which *Pliny* doth distinguish) but in *A.* they all go under the Name of *Tuttee*; which is nothing else but the the *volatile part* of *Brass*, when, in burning it sticks to the upper part of the *Furnace*, and the common sort of it is only *Calamine stone* calcined, of great use for *Medicines*.

see *Calaminaris*.

V A



VI

**V**APOUR, T. *Dunst*, and *Dampff*, A. *Vapour*, which ariseth sometimes from *heat*, and sometimes from *cold causes*. See *Evaporate*, *Quicksilver* and *Sublime*.

**VERNISH**, l. 2. c. 29. s. 4. T. *Furnaess*, L. *Vernix*; a compounded *liquid substance* made with *Oyls* and *Gums*, to make *Metals* or *Metallick Utensils* look *slick*, and resemble *Glass*, in which the *Indians* do excel.

**VEINE**, l. 2. c. 12. s. 1. T. *Gengen*, L. *Vena*, A. *Veine*; which *Minsbaw* (I suppose for *sound-sake*) writes *vain*, so making our *veins* but the *efflux* of *vanities*, but those who thought the *Terrestrial World* to be a great *Animal*, and that the *ebbing* and *flowing* of *Seas* are but the *systole* and *diastole* of its *breath*, might well believe that *Metals* and *Minerals* were the *Veins* of its *body*; but of the *nature* of *Metallick Veins*, G. *Agricola* gives the most exact *account*.

**VENETIAN Glass**, l. 2. c. 16. s. 5. T. *Venidischem-glassz*. L. *Vitrum Venetianum*, from the City *Venice*, where *Erckern* speaks that the best *Glasses* for *Metallick use* are made, and probably so in his time; but now that *Art* in *Venice* is thought to be *equall'd* in *England*: See *Glass*.

**VERDIGREASE**, l. 2. c. 27. s. 1. T. *Gruen-span*, A. *Spanish green*, L. *Ærugo*, or the *Rust* of *Copper*, by hanging *plates* of it over the *fumes* of *Wine*, from whence a *Crocus* will arise, which we call *Verdigrease*; See *Brass*, *Copper*, and in *Colours*, *Blew*, *Green*.

**VIAL** or *Glass Bottle*, l. 2. c. 30. s. 1. T. *Roelblein-Fiale*, and *Angster*, according to the proportions; L. *Phiala* and *Ampulla*,

*pulla*, A. *Vial*, to distinguish it from the Musical Instrument call'd *Violl*.

VINEGAR, l. 1. c. 33. f. 1. T. *Essig*. L. *Acetum*, A. *Vinegar*, now the various ways of making and using it, in *Metallick experiments*, may deserve a large *Discourse*, as being one of the great *secrets* of *Nature*.

VITRIOL, l. 2. c. 33, &c. T. *Schuster-schwaeitz*, L. *Vitriolum* and *Calcanthum* (which latter makes a black colour.) Now of *Vitriol* there are many natural sorts; but the three chief are 1. of a *Saphire colour*, (which comes from *Hungary* and *Cyprus*;) 2. of an *Emeral* or *green colour* (from *Swetbland* and *Goslar*;) often mentioned by *Erckern*; 3. a *white* (from *Denmark*, &c.) there is also an *Artificial Vitriol*, made from *Copper* or *Iron*, or both, which is called *Roman Vitriol*, or *Lapis Cælestis*, from its transcendent vertues; of which (besides what *Sir Kenelm Digby* writes; I could add many from my own experiments, but must refer them also to my intended *Essays on Agricola*; see *Brass*, *Copper*, and in *Colours*, *Black*.

ULTRAMARINE, which the *Italians* call *Azurò ultramarino*, and is a *Gem* found in *Mines*, sometimes called *Lapis Luzuli* (often mentioned by *Erckern*, l. 1. c. 2. f. 11, &c.) and is of a *pure blew*, and of which (either considered as a *Gem*, *Oar* or *Stone*) the *Italians* do make a pretious *Blew* for *Painters*, sold beyond the *price* of *Gold*.

VOLATILE, l. 1. c. 10. f. 9. T. *Flutch-tigon*, L. *Volatile* (which signifies a *Bird*, *Holiock*) according to *Paracelsus* it is used for any light matter, either ascending from *Metals*, or other light *substances*. See *Quicksilver*.

UPBUCKING, l. 4. c. 14. signifies some extraordinary *washings* of *Metals*, and so the word *upboyling*, is more than ordinary *boyling*.

URINE, l. 2. c. 8. f. 2, &c. T. *Dertlarne* and *Bruntz*, L. *Urina*, from *Uro*, because it is of a *scalding* and *burning nature*, of great use about *Metals*, it is *distill'd* and *extracted*, by a *natural heat* and *internal Furnace* in all *Creatures*, by which *natural*



tural extraction, we learn the method of all *salous productions*;  
See Salt, &c.

UTENSILS, T. *Brauchers*, L. *Utenfillia*, A. *Instruments*,  
useful tools, or household necessaries; but I must refer those which  
are mentioned by *Erckern*, to the Contents of the *Sculptures*,  
placed immediately before his first Book,) where you will find  
most of them recited, and referr'd to their pages, as also in the  
second part to their Capitals; only there is an *omission* of the T.  
and L. words for them, which will be rendred in *Agricola*.



WARDENS, l. i. c. 1. T. *Gwardeins*, L. *Guardianus*, A.  
*Guardian* and *Warden*; I intended an addition herein,  
to shew that the *Original* of this word, as to an *Of-*  
*ficial duty*, was first given to the *Warden* of *Mines*, and that  
all other *Offices* which bear the *Title* of *Wardens*, were *deriva-*  
*tives* from thence, viz. of the *Mines*, *Mint*, *Stanneries*,  
*Church*, *Ports*, *Fleet*, *Colledges* and *Companies*, which I shall  
hereafter enlarge and place according to their *Antiquities*.

WARM, T. *Warne* and *waerm*, L. *calidus*, A. *warm*,  
that is to bring *Metals* into a moderate warmth or heat.

WARTZ, l. i. c. 35. T. *Wartz*, A. the *Pin* of the *Beam*,  
and these are little pieces of *Iron* (like *Excrescencies*) filed out  
of the *Centre* of the *Ballance* on each side of it, which are fitted  
for the two little holes of the *Fork*, whereby the *Ballance* is  
made capable to move, and from hence our *English* word *Warts*,  
for excrescencies on the hands, or other parts, is used.

WASHING, l. 3. c. 2, &c. T. *washein*, L. *Lavare*, A. *Lā-*  
[M m] vations,

*vations*, and *Washings*; Now you may have a full account of the *manner of washing Metals* in N.N. before recited.

WASTE, T. *Vermuesten*, L. *Vastare*, A. to waste, consume or lessen the bulk of *Metals*.

WATER, T. *Wasser*, L. *Aqua, ex qua omnia* (as *Scaliger* and other more antient *Philosophers* define it.) See *Erckern* in many parts; and this subject of *Waters* might afford many *pleasing Discourses* of ours in *England*, and of such also as are of great *natural uses* in *Metallick Operations* besides *Artificial*, yielding *curious varieties*, especially from some *Waters* in those *Countries* which do not consist of *Mines*, where the waters only by heat of the *Sun*, without their *fire*, do yield a *perfect sediment* of *Gold Sands*.

WAVER, T. *Schwenneken*, L. *vagilare*, A. to wag to and fro: See *Trembling*.

WAX, T. *Wachz*, L. *Cera*, A. *Wax*. See *Cement* and *Glutination*.

WEATHER, l. i. c. 34. s. 8. T. *Wetter*, L. *Aether*, this hath great operation in *Metals*, for as the *Weather*, so *Metals* are *hard* or more *ductile*, &c.

WEIGHT, l. i. c. 36, &c. on which subject I did intend to enlarge; See *Measures*, and *Agricola de mensuris*.

WELL, T. *Brun*, L. *Puteus*, A. *Wells*, for *Springs* of *Water*, and called *Shafts* for *Metallick Wells*; see *Mines*.

WHEEL for waters, l. 4. c. 8. T. *Wasser-Radst*, L. *Haustrum*, used for the raising of *Waters* out of *Springs* or *Wells*, with which the *Miners* wash and purge the *Oars* from the earth or *rubbish*, and then the *Miners* may say *well*, the *Oars* are *well wash't* with *Well-water*, but of the description of the several sorts of *Wheels* you will see more in *Agricola*

WHETSTONE, l. i. c. 34. s. 9. T. *Wetzsteine*, L. *Cos*, which is used to *Metallick Instruments*, and to rub *Metals*.

WHITE, T. *Wize* and *blank*, L. *Albus*. See in *Colours*, *White*.

WINE, T. *weine*, L. *Vinum*, of various sorts and uses in *Erckern*. See *Pliny*.

WINE.

WINE-stone, *See* Argol, Tartar.

WOOD, T. *Wald* and *Haltz*. L. *Lignum*, A. *Wood*, of several sorts for *Metals*, *See* Charcoal Coals.

WOOL, T. *Wolt*, L. *Lana*, used about *Metals*.

WRINCLE, T. *Runtzel*, L. *Ruga*, that is, *Metal* not polite, but *scriveled*, *distorted*, and full of *contracted parts*, unusual to its natural *smoothness*, as in *hands*, *faces*, &c.

WYRE, T. *Kufforn dratt*, or *Copper drawn*, L. *Aurum netum*, i. e. *Gold Wire*, or *Gold* drawn or spun out of *Gold*; and *Filum Auricalcum*, or a kind of *Thread* drawn from *Copper*. A. *Wyre*, but I find no *Monosyllable* for it in any other *Language*.

X A



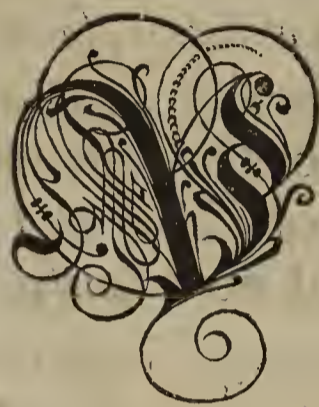
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XANTHUS, a pretious stone, which *Pliny* l. 37. calls also *Henni*, of great *virtue* to give success in *Mens* *Im-* *ployments*, and consequently to *Metallick* *Works*, *Ereker* doth not mention this, but speaks of *Hazel-Nuts*, from which Plant, the *Virgula Divina* (or *Divine Rod*) is made, by which *Mines* of *Gold* and *Silver* are discovered; and one of these I have out of *Germany*, but I cannot yet promise any *effects* by it: *See* *Georgius Agricola*, and my *Notes* on him.

XEROCOLLYRIUM, which is an *unguent* made of *Copper*, or *Copper* and *Lapis Calaminaris* mixt, to apply to such *Eyes* as are prejudiced by *Metallick* *Operations*, and this is help'd also by *Tuttee*, wash'd in *water*, then made into *pow-* *der*, and so into an *Oyntment*, which is commonly called *Un-* *guentum Tutium* or *Oyl* of *Tuttee*: XIPHON,

XIPHION or *Phasgenion*, *Pliny* l. 25. the root of which Plant stampt and mixt with *Wine* and *Frankincense* of equal Proportions, takes off all excrescent Scales from *Bones*, and may have the like effect upon the scales of *Metals*.

Y A



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YARD, See Measures.

YELLOW, T. *Galb* and *Geilb*. see in Colours, Yellow.

YEST, T. *Yest*, (but *Erckern* calls it *Hafin*, l. 2. c. 1. s. 3.) A. *Yest*, also *Barm*, *God's-good*, *Rising*, *Beer-good*, *Foam*, *Froth*: the *Latines* calls it *Spuma*: and the froth, *flores Cervisæ*, or the Flower of *Ale* or *Beer*, and *Cervisæ* they derive from *Ceres*, the Goddess of *Corn*, who first taught the sowing of *Wheat* and *Barly*, and of *Drinks* from thence: so that in *Norfolk* where it is called *Gods-good* it may well be alluded to the spirit of that Goddess's Good which she infused into it, as a firmentation: but more properly to be attributed to *God* himself, for communicating so great a Secret for the Benefit of *Mankind*: for without *Fermentation* scarce any useful thing is perfectly attained unto, and that Motion doth operate not only in the *terrestrial Orb*, both by *sea* and *Land*, but on the *Elements* and *celestial Orbs*. See *Litarge*.

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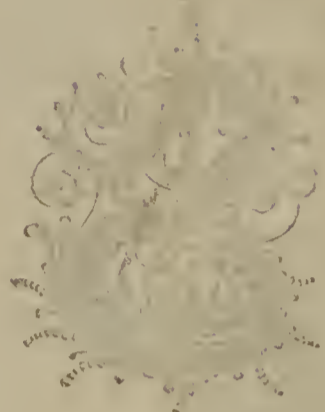
ZUITER, l. 4. c. 11, 12, and 13. explain'd to be *Tin* well beaten, and 'tis not only thus with *Metals* which must be *beaten*, (that the *Advantages* may redound to themselves in a more refined *temper*, and make them useful to the *World*) but we see that *Corn* must be *thrash'd*, and ground for *food*: *Grapes* and other *fruits* contused to make *Liquors* more acceptable, and man himself must undergo *Oppressions* to make him happy, which I here mention as my *Conclusion*, in Imitation of *Erckern* his *Zeal* for *God's* *Glory*, wherewith he concludes the last page of his five *Books*; for according to the *Maxim* of the *Rosy Crucians* (and best *Chimists*) *Excellentissima dona absque Pietate vana*: which may be rendred thus, *By true Piety the bravest Sciences are accomplished.*

FINIS.

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